Implementing International Standards for "continuing supervision"

by

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ABSTRACT

The *Outer Space Treaty* established the obligation to provide continuing supervision of its national space activities by the appropriate state. The implementation of this obligation remains a matter of state discretion. Since this Treaty came into force the world has evolved to become reliant on space based utilities to enable the global economy and state governance. Today, space faring states are increasingly dependent upon the supervision practices of other states to assure its space interests as the attribution of state responsibility becomes more difficult to ascribe.

Therefore, the absence of binding supervision standards may become an impediment to future space applications due to three identified trends. First, the trend towards space commercialization requires active state supervision. Second, the rise in environmental hazards requires minimal safety standards to decrease the harmful effects on space applications. Third, space security requires identification of intentional acts and prudent measures to safeguard vital space applications.

RÉSUMÉ

Aux termes du Traité sur l'espace extra-atmosphérique, les activités nationales dans l'espace extra-atmosphérique doivent faire l'objet d'une surveillance continue de la part de l'État approprié. Chaque État partie au Traité est libre de choisir les moyens par lesquels il entend exécuter cette obligation de surveillance. Depuis l'entrée en vigueur du Traité, les technologies utilisant l'espace extra-atmosphérique sont devenues parties intégrantes de l'infrastructure et du fonctionnement des économies et des gouvernements. Conséquemment, la façon dont chaque État s'acquitte de son obligation de surveillance met en jeu les intérêts des autres États qui dépendent de ces technologies. Or, en cas de dommages, il pourrait être difficile d'attribuer la responsabilité à un État particulier.

L'absence de régime encadrant les activités spatiales pourrait poser plusieurs obstacles au développement des techniques spatiales et de leurs applications. Trois phénomènes soulèvent des préoccupations particulières. Premièrement, aucune activité commerciale ne peut avoir lieu dans l'espace extra-atmosphérique sans la surveillance d'un État. Deuxièmement, la pollution du milieu extra-atmosphérique devient un problème aigu et le besoin de créer des règles de pratiques en la matière se fait de plus en plus sentir. Troisièmement, la sécurité spatiale ne peut être assurée que par la mise en oeuvre de mesures de protection et d'identification des responsables en cas de dommages.

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I. INTRODUCTION

A. Origin of State Supervision

> *The activities of non-governmental entities in outer space shall require authorization and continuing supervision by the State concerned.*
> *-Declaration of Legal Principles Governing the Activities of States in Outer Space*

The principle of state responsibility for national space activities was born out of the Cold War arms control negotiations between the former Soviet Union and the United States. During these negotiations, the Soviet's initial position was to limit space activity to government agencies and the United States' position was to open space to private entities. The negotiations resulted in both government agencies and non-governmental entities active in space, but under the expressed authorization and continued supervision of the state. This political compromise was aided by the fact that both sides of this contest obfuscated their respective space activities to avoid revealing their true capabilities and limitations. This practice necessitated all space activities of the respective states be subject to the negotiated restraints for this space agreement to be meaningful.[1] The innovation of national space activity including both governmental agencies and non-governmental entities first occurred through a non-binding resolution adopted by the United Nations' General Assembly in 1963[2] as spy satellites and other military space applications were operating under the cover of scientific programs.[3] The State Parties to the *Outer Space Treaty*[4] adopted nearly identical language to the earlier resolution binding themselves to the obligation of continuing supervision over non-

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[1] Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: John Hopkins University Press, 1985) at 272.

[2] *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, GA Res. 1962 (XVIII), UN GAOR, 18th Sess., Supp. No. 15, UN Doc. A/5515 (1963).

[3] David Darling, *The Complete Book of Spaceflight, From Apollo 1 to Zero Gravity* (Hoboken, New Jersey: John Wiley & Sons, Inc., 2003) (*Corona* was the United States' first imagery intelligence satellite program launched over 100 times under the cover of the *Discoverer* scientific program from 1959 to 1972. Launched into polar orbit aboard an Air Force Thor rocket, it photographed the Soviet Union and ejected the film to be recovered by an aircraft which captured the film drum as it descended by parachute. *Corona* was declassified in 1995. The *Cosmos* series was launched by the Soviets/Russians for both scientific and military purposes since 1962. The series included military electronic intelligence, reconnaissance, communications, and navigation satellites. The Soviet system characterized all space activities as scientific and concealed the true objectives of these missions).

[4] *Treaty Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, 610 U.N.T.S. 205, 18 U.S.T. 2410 [*Outer Space Treaty*].

governmental, or private, space activity in 1967[5] as manned space activity progressed from brief orbital missions to extended lunar expeditions and the inhabitation of space stations with military applications.[6]

The general principle of state responsibility for national activities in space is evident for governmental agencies as the respective states appropriate funds for its space programs, albeit obscured for national defense and domestic security interests. Also, government officials, or their contracted representatives, participate in the planning, construction, operation, and supervision of their governmental space programs to ensure a successful outcome. Conversely, commercial entities operate out of self interest; therefore, they are subject to the general supervision exercised by government to ensure compliance with its common regulations, such as, labor standards, environmental protection, revenue collection, etc.[7] But, these regulations secure domestic interests, not the type of interests the foreign state signatories to a public international treaty seek to protect. Therefore, the *Outer Space Treaty* specified the twin requirements of authorization and continuing supervision for commercial space activities.[8] The authorization obligation requires the appropriate state to exercise its sovereign power to restrict space activity to those it authorizes. As a consequence of its authorization (explicit or implicit), the state bears international responsibility in general and liability for the damage such activity may cause.[9] The space law authors[10] thoroughly address state

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[5] *Ibid*. at Article VI.

[6] *Supra* note 3 (The *Salyut* series of Soviet space stations from 1971 to 1985 were used for both civilian and military use. In particular the *Almaz* military missions carried a synthetic aperture radar operated by a military crew to obtain high resolution surveillance of land and ocean surfaces, and it was also armed with a cannon to defend the station against an American attempt to dock with it while on orbit. The *Skylab* space station operated by the United States from 1975 to 1979 was for civilian use, while the Air Force developed the *Manned Orbiting Laboratory (MOL)* for military use as a manned optical and radar surveillance station like the Soviet *Almaz*. The *MOL* was cancelled in 1969 before coming into operation because the unmanned intelligence satellites provided an adequate capability at reduced cost and risk.)

[7] See e.g. 49 U.S.C. 70117(c)(2).

[8] *Outer Space Treaty*, *supra* note 4 at Article VI ("non-governmental entities" include those entities which are not governmental. The term private indicates an individual or activity which is not official or public in nature, while the term commercial is used by the supervision regime of the United States to emphasis the business affiliation and control as opposed to government control. Both terms are used in the literature, and either term can be confused when the activity engaged in is government directed but the space goods and services are obtained from a non-governmental source. The term commercial when used in this paper will normally be used to indicate the ownership or control over the entity or activity described).

[9] *Ibid*. at Article VII.

responsibility for authorization as evidenced by the state's conduct, territory, launch facility, or procurement of a launch for commercial activity.[11] The size and nature of space launch activities make the authorization obligation relatively easy to ascertain or impute when necessary. The more difficult challenge for the international community lies in ascertaining compliance with the continuing supervision obligation. The transmission of commands to the spacecraft may be difficult to detect or decipher. And, direct observation of all operations on orbit is not feasible. Thus their effects are not discovered until after the harmful interference or destruction occurs.

Continuing supervision, or simply supervision, addresses the operation of spacecraft until its eventual disposal.[12] The *Outer Space Treaty* provides no guidance on the scope, development, or implementation of supervision standards. The vagueness of this obligation was not controversial during the negotiations as all space activity by its nature involved governmental oversight at that time.[13] The purpose for this principle was to increase the breadth of national activity to allow the proper attribution of a given space activity to the responsible state.[14] Once attributed, the State Party is internationally liable for the damage resulting from the activity subject to its supervision. Therefore, at a minimum the state has a financial incentive to provide adequate supervision to curb its international liability[15] and in the worst case scenario to prevent attribution for an aggressive act.[16] Thus, mischievous space activity does not avoid ascription to the responsible state by mere obfuscation of state activity. However, the Cold War

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[10] See e.g. Bin Cheng, "Article VI of the 1967 Space Treaty Revisited: *International Responsibility, National Activities,* and *the Appropriate State*" (1998) Journal of Space, Law Volume 26, Number 1 at 8 (see note 2).

[11] *Supra* note 4 at Article VII; *Convention on the International Liability of Damage Caused by Space Objects*, 29 March 1972, 961 U.N.T.S. 187, 24 U.S.T. 2389 [*Liability Convention*] at Article I(c).

[12] Inter-Agency Debris Coordination Committee, *IADC Space Debris Mitigation Guidelines* (2004) at 3.5.3, online: Inter-Agency Space Debris Coordination Committee <http://www.iadconline.org/> [*IADC Guidelines*] ("disposal phase begins at the end of the mission phase for a space system and ends when the space system has performed the actions to reduce the hazards it poses to other space systems").

[13] *Supra* note 1 (Soviet policy position was that all space activity should be governmental and United States established Comsat to supervise the limited commercial space activity at the time with the *Communications Satellite Act of 1962*).

[14] *Supra* note 4 at Article VI; *Cheng, supra* note 9 at 29 ("All in all "the appropriate State" appears thus to be a rather elusive notion. In practice there may well be more than one "appropriate State", *de facto* or even *de jure*").

[15] *Liability Convention, supra* note 11.

[16] *Charter of the United Nations* at Article 2(4).

opponents retained the political benefit of operating under cover while international stability was maintained by associating national activity with state responsibility.

B. Thesis Statement and Outline

> *The activities of non-governmental entities in outer space … shall require authorization and continuing supervision by the appropriate State Party to the Treaty.*
>
> -*Outer Space Treaty*, Article VI (2)

The *Outer Space Treaty* established the obligation to provide continuing supervision of its national space activities by the appropriate state. The implementation of this obligation remains a matter of state discretion. Since this Treaty came into force the world has evolved, becoming reliant on space based utilities to enable the global economy and state governance. Today, space faring states are increasingly dependent upon the supervision practices of other states to assure its space interests as the attribution of state responsibility becomes more difficult to ascribe.

Therefore, the absence of binding supervision standards may become an impediment to future space applications due to three identified trends. First, the trend toward space commercialization requires active state supervision. Second, the rise in environmental hazards requires minimal safety standards in order to decrease their harmful effects on indispensable space applications. Third, space security requires identification of intentional acts and prudent measures to safeguard vital space applications. Critical to all three trends is the ability to attribute space activity to a responsible state, establish minimal standards to safeguard the beneficial use of space by others, and provide a means to ensure compliance.

This thesis is presented by first exploring the origin of state supervision over national activities, its evolution from the Cold War to the Globalization eras, and the current trends now affecting the future utility of supervision. Next, the current international requirement for supervision and the applicable standards are described. This includes the *Outer Space Treaty* regime applicable to supervision and other sources of international law outside the scope of Article VI, but which play a significant part in creating *de facto* supervision standards. Following this is a demonstration of its implementation by the United States, and a review of multiple supervising

administrations as no one department or agency is solely responsible for the supervision of all national space activity within the United States. Finally, proposed supervision standards are compared to the needs and practices observed. The analysis provides parameters to create effective supervision standards for commercial space activity, space safety and space security.

C. Evolution of Space Development

> [*After* Sputnik] *the fundamental relationship between the government and new technology changed as never before in history. No longer did state and society react to new tools and methods, adjusting, regulating, or encouraging their spontaneous development. Rather, states took upon themselves the primary responsibility for generating new technology. This has meant that to the extent revolutionary technologies have profound second-order consequences in the domestic life of societies, by forcing new technologies, all governments have become revolutionary, whatever their reasons or ideological pretensions.*
>
> -The Heavens and the Earth
> by Walter A. McDougall

> [*D*]*epartments and agencies shall use U.S. commercial space capabilities and services to the maximum practical extent; purchase commercial capabilities and services when they are available in the commercial marketplace and meet United States Government requirements; and modify commercially available capabilities and services to meet those United States Government requirements when the modification is cost effective.*
>
> -U.S. National Space Policy

The present commercial space environment is much different from the one existing at the creation of the space treaty regime.[17] The Soviet Union and the United States then recognized the potential use of space as the military high ground in this confrontation. Both feared a momentary advantage gained by the opposing side in this realm would result in a loss of confidence by their respective alliance or worse, an

[17] *Outer Space Treaty*, *supra* note 4; *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, 22 April 1968, 672 U.N.T.S. 119, 19 U.S.T. 7570 [*Rescue Agreement*]; *Liability Convention*, *supra* note 11; *Convention on the Registration of Objects Launched into Outer Space*, 12 November 1974, 1023 U.N.T.S. 15, 28 U.S.T. 695 [*Registration Convention*]; *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 18 December 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 [*Moon Agreement*].

opportunistic military confrontation. Therefore, the massive technocracies[18] carried over from World War II rapidly pursued the next logical technological barrier to waging total war by creating the space age.[19] Space was initially used for propaganda[20] to demonstrate the strength of their respective economic theories. This was followed by surveillance from space to gain strategic intelligence and by telecommunications to control forces and distribute ideology. Additional space applications evolved as technology and imagination developed this new environment.[21] Although for now space continues to be dominated by governmental activity, commercial activity is rapidly increasing as governments divest their costly technocracy organizations and the demands of an information based global economy drives future space investment.

From 1967 to 1984, five space treaties were negotiated and came into effect. Remarkably, the Soviet Union and the United States, who generally controlled the negotiation of these treaties, managed to create a legal regime to mitigate the arms race and substitute in part a civil space competition whose benefits have spurred the globalization phenomenon experienced today. The space law developed under the threat of nuclear war waged through the space domain has remained surprisingly stagnant.[22] Subsequently, space law advancement is limited to non-binding or "soft" law[23] arrangements with the exception of those obligations created by the International Telecommunication Union (ITU) to better manage the radio frequency spectrum and its

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[18] *Supra* note 1 at 5 ("Let us define technocracy therefore as follows: the institutionalization of technological change for state purposes, that is, the state-funded and [state]-managed [Research and Development] explosion of our time").

[19] *Ibid.* at 6 (technocracy achievements during World War II include: the atomic bomb and computer by the United States; ballistic missile by Germany; and, radar by Great Britain).

[20] *Supra* note 3 (*Sputnik* launches beginning 10 October 1957, achieving for the Soviets the first satellite, first dog, and the *Vostok* launch of the first person into space. For the United States, *Vanguard* exploded at the launch pad on 6 December 1957 in front of the media, but the *Explorer* launch on 31 January 1958 marked the first American satellite. Subsequently the United States achieved the first photo of earth from space, put first primate in space, and with *Mercury* placed the first man in earth orbit.).

[21] *Ibid.*

[22] *Moon Treaty, supra* note 17 (negotiated in 1979 and failed to be adopted by any major space faring state, and the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) failed to produce subsequent treaties).

[23] An example of "soft" law are the General Assembly Resolutions of the United Nations (e.g. *Principles Relating to Remote Sensing of the Earth from Outer Space*) which contain statements, principles, guidelines, and codes strongly resembling treaty provisions. The term "soft" law is controversial because some view the term as an oxymoron as law is either binding or nonbinding upon a particular state. Others find this term fittingly descriptive of the trend toward using such mechanism to reach a consensus on aspirational goals without forming an immediately binding agreement, but rather a step toward creating future international obligations through the establishment of norms.

associated orbital positions to avoid harmful interference by an uncoordinated use of space stations. In contrast, many international legal regimes have experienced vast change since 1989 to reflect the substantial political and economic changes society has experienced.[24] It is logical that some space law advocates are frustrated by the failure thus far to modernize, if not transform, the existing body of international space law through the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUSO) and the Committee on Disarmament (CD). Many recognize the growing obsolescence of this regime as the use of space evolves. But two distinct camps have formed on the question of future binding space law. Arms control advocates wish to advance the agenda initiated during the Cold War in order to capitalize on the present lack of hostile space competition to safeguard space from future armed conflict.[25] On the other hand, traditionalists are confident in the validity of the original principles and wish to confine the development of international law to those initiatives which fit within the current construct of the use of space.[26] The constituents of these opposing positions have managed to erect a loggerjam to space law development. But, each community may actually have a common interest in addressing space commercialization, safety, and security needs if accomplished without lapsing back into a debate over constraints on governmental space activities.

The drive towards commercializing space is the result of a complicated balance of market forces and state imposed controls. Space technologies grew through both military applications and civilian exploration projects. Together, government directed projects propelled missile and satellite technology to exceed the reliability threshold which aviation obtained in the 1940s when commercial applications soared as the peacetime economy returned following World War II. Similarly, the end of the Cold War was expected to create new opportunities for space transportation and applications as outdated restraints such as those imposed by the *Coordination Committee for Multilateral Export Controls (COCOM)*[27] were lifted. But, the threat posed by non-integrating societies to

[24] See e.g. Douglas A. Irwin "GATT Turns 60" *Wall Street Journal* (7 April 2007).
[25] Sarah Estabrooks, "A space weapons ban: Laying the foundation" (2004) 25 The Ploughshares Monitor 3.
[26] The White House, *U.S. National Space Policy* (2006) [Unclassified].
[27] Formed in 1949 as a Cold War multilateral agreement by the west to prevent sensitive armaments and dual use goods and technologies reaching the communist countries by Australia, Belgium, Canada,

the emerging global economy prevented the abandonment of these export controls.[28] What is difficult to predict is to what degree and for how long this impediment will impair the advancement of space commercialization. Or, if the self imposed isolation by the United States through its *International Traffic in Arms Regulations (ITAR)*[29] implementation will cause the United States to trail rather than to lead this market. These open questions are critical for the United Sates as the next technical development will spur space activity by merging aviation and space technologies to create a truly reusable launch vehicle (RLV). This development will kick start commercial space transportation by moving the highest value international transportation demand from aviation to space transportation. In return, this will enable space applications heretofore considered too risky or expensive for want of a dependable launch and reentry system.

A second trend toward commercialization of space activity is the divesture of space infrastructure by government. The initial missile development[30] and the subsequent national space programs[31] are mature governmental projects whose initial inspiration now wanes. Democratic governments change their priorities over time and this change is reflected in the budgets requested by the President and enacted by the Congress. Less transitory are the legacy defense and civil space bureaucracies who retain their statutory mandates to perform a host of government space activities. Some mandates are inherently governmental, such as those services necessary to ensure the national defense and security. Other mandates direct departments and agencies to oversee beneficial scientific developments, which only governments will fund. A third justification is to provide space based utilities beneficial to society as a whole which will enable economic growth. Regardless of the motivating interest, government managers are challenged to find ways to fulfill these mandates on a reduced portion of the national

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Denmark, France, Germany, Greece, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, the United Kingdom and the United States. The agreement terminated in 1994 as a result of the end of the Cold War. The Soviets and the Eastern Bloc also exercised export controls against NATO countries.

[28] See *Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies; Australia Group; Missile Technology Control Regime (MTCR); Nuclear Suppliers Group; and Zangger Committee* [*Export Controls*].

[29] *International Traffic in Arms Regulations*, 22 C.F.R. §§ 120 et seq. [*ITAR*].

[30] See e.g. s*upra* note 3 (United States Army *Redstone*, United States Navy *Vanguard*, and United States Air Force *Atlas* programs).

[31] See e.g. *ibid*. (NASA *Explorer, Mercury,* and *Apollo* programs; NOAA *Television Infrared Observation Satellites*).

budget. Since the 1980s, a favored method of government cost reduction has been privatization. This practice has delayed the long term impact such funding reductions ultimately have on any program. To retain some capability within all programs, space activities continue their migration toward commercial entities as the government resources are directed to other programs.[32]

The cost savings predicted by privatization advocates results from commercial entities assuming the technology risk previously funded exclusively by governments.[33] Incremental innovations to improve efficiency in an effort to reduce operating costs are now possible as the basic space technology is proven, placing commercial providers in a better position to respond to the space market with the exception of the export controls previously referenced. The government cash cow guarantees the survival of commercial providers through large and often unsuccessful contract awards from a consolidated manufacturing base.[34] Thereby, the United States retains the national prestige of possessing a space program by guaranteeing a purchaser for yesterday's space capability with the option to purchase tomorrow's technology when it becomes commercially available.[35] The commercialization trend is instituted in the *1998 Agreement Concerning Cooperation on the Civil International Space Station*[36] by explicitly recognizing commercial use in its objective as well as national policy.[37]

Two major trends are driving the move away from exclusive governmental control over its national space activity. First, the state of RLV technology now creates the prerequisite building blocks for truly global space based utilities. Second, the largest spenders on space now rely on commercial entities for nearly all of their launch services, satellite production, and technology development for future space applications. The significance of this public/private relationship is the preference for the private

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[32] William J. Broad, "New Work Proposed For Shuttles: Salvage in Space" *The New York Times* (16 September 1997).
[33] Warren E. Leary, "Panel Says Bush's Space Goals Are Feasible" *The New York Times* (17 June 2004).
[34] Philip Taubman, "In Death of Spy Satellite Program, Lofty Plans and Unrealistic Bids" *New York Times* (11 November 2007); Andy Pasztor, "Prospects Fade for Pentagon Satellite Plan" *Wall Street Journal* (26 December 2007).
[35] *Supra* note 26.
[36] *Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station*, 29 January 1998, online: NASA <ftp://ftp.hq.nasa.gov/pub/pao/reports/1998/IGA.html> at Article 1.
[37] See e.g. National Aeronautics and Space Administration, *2006 NASA Strategic Plan* (2006) at 17-18.

commercial space sector to resource governmental activity to reduce its costs and to spur new private space activity. Therefore, one must distinguish commercial activity in support of governmental activity from the non-governmental activity subject to supervision.

D. Current Trends and Analysis

> [*W*]*hen the world starts to move from a primarily vertical (command and control) value-creation model to an increasingly horizontal (connect and collaborate) creation model, it doesn't affect just how business gets done. It affects everything.*
>
> - The World is Flat by Thomas L. Friedman

The Pulitzer Prize winning author Thomas L. Friedman describes the phenomenon of globalization in the defense of his thesis that *the world is flat*.[38] He explains how the competitive playing field has been leveled for both industrial and emerging market states through the growth of technology and expansion of liberalization. Space utilities are not specifically included as one of the ten *flatteners*[39] used to describe a world integrating to more efficiently compete for trade and cultural exchange. However, space applications are a ubiquitous utility enabling the current level of *flattening* Friedman observes, and it will be essential to the further *flattening* he predicts to come. Primarily built for the benefit of the industrial nations, these utilities are indispensable to opening the emerging markets.[40] The exponential gain made possible by space based global utilities for the least integrated states who lack basic infrastructure allows them to skip several evolutions of development by plugging into the current

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[38] Thomas Friedman, *The World is Flat (Further Updated and Expanded): A Brief History of the Twenty-First Century* (New York: Picador, 2007) at c. 1 (metaphor for viewing the world as flat or level in terms of commerce and competition, as in a level playing field, or one where all competitors have an equal opportunity created by the author after interviewing a business person in Bangalore, India).

[39] *Ibid.* (ten events and technologies enabling a *Flat World*: 1. 11/9/89, When the walls came down and the windows went up; 2. 8/9/95, When Netscape went public; 3. Workflow Software, let's do lunch – have your application talk to my application; 4. Open sourcing, self-organizing collaborative communities; 5. Outsourcing, Y2K; 6. Offshoring, running with gazelles, eating with lions; 7. Supply-chaining, eating sushi in Arkansas; 8. In-sourcing, what the guys in funny brown shirts are really doing; 9. Informing, Google, Yahoo!, MSN Web Search; and, 10. The Steroids, digital, mobile, personal, and virtual (…wireless being the icing on the cake)).

[40] *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interests of All States, Taking into Particular Account the Needs of Developing Countries*, GA Res. 51/122, UN GAOR, 51st Sess., Supp. No. 20, UN Doc. A/51/20 (1996) 1.

cutting edge telecommunications, remote sensing, and navigation services without a costly infrastructure by simply obtaining the end user devices. However, Mr. Friedman recognizes that segments of these societies wish to remain non-integrated because of the offensive content or the loss of control such integration brings. Unfortunately, the post Cold War world presents new threats to the *Flat World* which jeopardize the benefits of globalization for both the industrial and emerging market countries.[41]

Space applications promise to expand to include transportation, space tourism,[42] solar energy distribution,[43] and inhabitation in the near future.[44] Satellite telecommunication was the first commercially available space service beginning with the Telstar series[45] in 1962, and each year 10-20 communications satellites are added to the existing constellation.[46] Early technology was limited to fixed satellite services (FSS) relayed through a geostationary satellite by transmitting from one point on earth large volumes of data to relay phone calls, television programs, financial transactions, embassy communications, etc. to a large stationary antenna. As technology improved, broadcast satellite services (BSS) enabled the distribution of primarily television and radio programs to smaller antennas within a given service area, eliminating the costly infrastructure cable companies and radio broadcasters previously required to enter these markets. And finally, the advent of Global Mobile Personal Communication Satellites (GMPCS) constellations in low earth orbit allows two-way communication from handheld sets to combine phone and internet to a global service area.[47]

Remote sensing or earth imaging applications make the entire globe virtually accessible. The term remote sensing best reflects the nature of this technology as it allows more than a photographic image of the earth's surface by a spacecraft. The sophisticated sensors now commercially available can see through clouds and smog to

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[41] *Supra* note 38 at c. 15; Thomas P.M. Barnett, *The Pentagon's New Map, War and Peace in the Twenty-First Century* (New York: G.P. Putnam's Sons, 2004).
[42] Andy Pasztor, "Economy Fare ($100,000) Lifts Space-Tourism Race" *Wall Street Journal* (26 March 2008).
[43] Department of Defense National Security Space Office, *Space-Based Solar Power as an Opportunity for Strategic Security* (2007).
[44] Jeff Foust, "Big plans, low prices" *The Space Review* (16 April 2007).
[45] *Supra* note 3 (Telstar was the first commercial communications satellite which grew into a global network owned by At&T but operated by NASA).
[46] David J. Whalen, "Communications Satellites: Making the Global Village Possible" (27 July 2007) online: NASA History Division <http://www.hq.nasa.gov/office/pao/History/satcomhistory.html>.
[47] *Supra* note 3.

provide the user an image replicating the human view. Or, the analyzed data can determine the chemical components of the surface of the earth, temperatures, moisture level, movement, and they can track change over time. One satellite in polar orbit may periodically revisit any point on earth and a single satellite in geostationary orbit may keep a given point under constant observation. This technology allows the fishing crew to locate scarce resources by locating their allotment with minimal time and fuel consumption. Or the Coast Guard to conserve natural resources by monitoring the activity within its territorial sea. Employed by weather observation satellites operated by the government, this technology is available to commercial users to track and predict weather patterns. The emerging science of space weather benefits from satellite sensors oriented away from the earth to forecast emissions from the sun and outer space to protect and optimize space operations and terrestrial activities such as power grids affected by solar variations.[48]

The positioning, navigation, and timing services available through Global Navigation Satellite Services (GNSS)[49] (like other space applications) began out of military necessity to locate, target, and coordinate military forces around the world. Today's GNSS remain under military control, but the architecture is partially opened for commercial use. Its use by the International Civil Aviation Organization (ICAO)[50] as the future backbone of civil aviation's air navigation services through the Communication, Navigation, Surveillance of Air Traffic Management (CNS/ATM)[51] program will greatly enhance aviation by lowering the separation requirement between aircraft and through more efficient routing to optimize an increasingly crowded airspace. This enhancement will benefit energy conservation and the environmental impact of aviation.

This is just one example of the paradigm shifting capability of a single space application. GNSS also generates billions of dollars in the sale of portable devices and associated services. This technology increases productivity and reduces energy consumption by resolving two dilemmas that have confounded mankind throughout the

[48] *Ibid*.
[49] *Ibid*. (Global Positioning Satellite by United States; GLONASS by Russia; GALILEO under development by European Union; Beidou regional system and Compass under development by China).
[50] ICAO is established under the *Convention on International Civil Aviation*, 7 December 1944, 61 U.N.T.S. 1180, 61 U.S. Stat. 1180 [*Chicago Convention*].
[51] International Civil Aviation Organization, *Global Air Navigation Plan, Third Edition*, Doc 9750 AN/963 (2007).

ages; constantly providing both his location and reliable directions to his destination. A visitor can navigate a metropolitan area as easily as she can drive the streets of her hometown. The efficiency to be gained by transportation of goods, delivery of services, and recreation is available globally. And, the precision timing obtained through atomic clocks onboard the GPS constellation is instrumental to financial transactions, power grid management, and synchronization of computer networks.[52]

Finally, space transportation provides the means of delivering payloads to space. The Office of Commercial Space Transportation (AST)[53] in 2005 estimates that the present international commercial space transportation market demand at 15-20 launches per year will be satisfied by the proven expendable launch vehicle (ELV) technology.[54] AST provides the following details for commercial space activity in 2007. A total of 68 launches occurred worldwide, of which 23 were provided commercially. The commercial launches were provided by Russia (12), Europe (6), United States (3, but licensed 4), India (1), and multinational sea based launch (1).[55] The current market falls far short of the 1,200 launches in ten years predicted in the 1990s before the *Dot Com* bust. Nonetheless, AST has postured itself to address the predicted increase upon introduction of a safe and affordable RLV.[56]

The introduction of the RLV will fundamentally change the commercial environment by the addition of human transport and the emergence of multiple spaceports. The success of Space Ship One's suborbital flight in 2004[57] and the proposal by Virgin Galactic to commence suborbital operations as early as 2008[58] signal the commencement of this change. Perhaps the volume and range of activity predicted a decade ago was not an illusion, but merely delayed for the reasons addressed above. Operators are preparing the way for suborbital point-to-point transportation for

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[52] *Supra* note 3.
[53] *Commercial Space Launch Act of 1984*, 49 U.S.C. § 70101; The White House, Executive Order 12465 (1984).
[54] Federal Aviation Administration, *Concept of Operations for Commercial Space Transportation in the National Airspace System, Addendum 1: Operational Description* (2005) at 1.
[55] Federal Aviation Administration, *2008 U.S. Commercial Space Transportation Developments and Concepts: Vehicles, Technologies, and Spaceports* (2008) at 6-12.
[56] *Ibid.*
[57] John Schwartz, "Private Rocket Ship Visits Space Again to Win $10 Million Prize" *The New York Times* (4 October 2004).
[58] *Supra* note 42.

passengers and time sensitive cargo, and routine orbital operations. Routine orbital operations would find a ready market in support of the International Space Station, leisure travel, hub and spoke space transportation system, satellite deployment and recovery, as well as space science, exploration, manufacturing and medicine. To support any of these operations, the human space transportation aspect will be subject to extensive safety regulations as currently under development by AST. And the effect of multiple spaceports to accommodate these diverse operations will impact an already burdened air traffic management systems.[59]

Returning to Mr. Friedman's view of globalization, the result of space enhanced connectivity is a networked supply chain. This chain is enabled by the retailer transmitting via satellite its daily sales activity back through this chain in order to bring products and services to market more efficiently and with less cost to the consumer and the environment. When space applications are combined, the position of trucks, trains, ships, aircraft, and even the individual cargo containers are visible to the global supply chain managers. Telecommunication links connect knowledge centers, data, and human resources around the world. Production is increased by showing the farmer which crop is most compatible with the soil. Raw material suppliers are aided in their search for new and more accessible sources. Administrations can link the best customer call center to connect the customer to a product or service. Or, physically connect the customer to the nearest outlet through a Google Earth map link. And, the swipe of the customer's bank card triggers the distribution of wealth along this supply chain. The potential to connect and enable global business via satellite applications is limited only by an entrepreneur's imagination.[60]

Even more personally, the family car demonstrates our present reliance on space based applications for convenience. It allows the owner to know her location at all times, while providing directions and traffic and weather reports. In remote areas it connects the driver with the internet to check messages, make calls, and download a satellite image or street view image of the destination. It provides consistent satellite radio programs at

[59] *Supra* note 55.
[60] *Supra* note 38 at 136 ("So the minute Wal-Mart's meteorologists tell headquarters a hurricane is bearing down on Florida, its supply chain automatically adjusts to a hurricane mix in the Florida stores – more beer early, more Pop-Tarts later").

any location. If in trouble, the driver is connected with an operator. And, if the car is stolen it disables and locates the car from orbit. Even the criminal foolish enough to steal a space enabled car may himself be linked to the same constellation of satellites via an ankle bracelet to be monitored by a probation officer. This hypothetical demonstrates the importance of satellite applications to everyone integrated into this global economy, not just those involved in international business.

The synergy of these space applications is rapidly changing the way the world conducts itself for both good and ill. It is difficult to overestimate the impact space applications have on modern life. The increasing ability to exchange digital content from any point on earth coupled with the processing capability of the personal computer makes the present concept of globalization a mere foretaste of the technological savvy of the world to come. No one can predict the impact a sudden loss of a given space based utility would have on the world community. What is certain is that most are unaware of how reliant they are on space applications. Those who believe they can turn back progress without adversely impacting their own society by diminishing the capacity to use space are dangerously naive. Space commercialization, safety, and security are the three trends the Cold War paradigm of supervision may not be equipped to address.

1. Space Commercialization

> *Although RLV development has been hindered in the past by a number of factors, the pace of development has recently accelerated in response to competition for the $10 million Ansari X Prize. Successful completion of that competition proved that private companies can develop ways to travel to space without the extreme expense of government funded programs.*
>
> - Concept of Operations for Commercial Space Transportation in the National Airspace System, Addendum 1: Operational Description

The commercial space environment has materially changed since Article VI of the *Outer Space Treaty* came into force. During the period of the Cold War, the obligation of continuing supervision for commercial space activities was satisfied by the appropriate state through its close interaction with the commercial operator as its largest customer and regulator. Today, the interest of the appropriate state is guaranteed access to legacy

space applications in exchange for a reduced portion of the federal budget. The commercial operator's interests are likely to drift from those of the shrinking government customer base. As it absorbs governmental activity and consolidates excess capacity to compete in a global market by offering space based utilities at the direction of investors, the egalitarian and national security motives of the past will be lost. In a market based system, the combination of consumer demands and investor risk will drive commercial space decisions. This is a fundamentally different environment from idealistic objectives funded on a *cost-plus contract*[61] basis. As with all great industries, the government's evolving role as customer and regulator requires a careful hand to encourage expansion of space services, increase the benefits of space applications, and ensure standard services when required. But, regulators must also check the threat of harmful interference with other space users, guarantee its own access, limit access to only responsible users, and exercise appropriate monitoring. The heart of supervising commercial space activity is ensuring space is used for the public good.[62]

Commercial space transportation systems are the key to purely commercial space activity. Obtaining launch services from state launch providers or their dependent commercial providers at government launch facilities makes authorization and supervision an explicit requirement. But launch providers such as Sea Launch, LLC, an international consortium, reveal both the prospects of liberation from government space services and the challenge to supervision in the future.[63] The traditional ELV launch services are required for all commercial deployments except those authorized aboard the Space Shuttle.[64] But the emergence of the RLV will permit the launch, deployment, maintenance, and recovery of satellites in the low earth orbit (LEO) by an operator from nearly anywhere. RLVs will make possible the rapid transportation of high value items

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[61] *Federal Acquisition Regulation* 48 C.F.R. Chapter 1 (*Cost plus* provides a method to determine the contract price when it is difficult to predict the actual costs. Cost plus pricing is used in developmental contracts by adding the cost of direct material, direct labor and overhead, plus a fixed fee or profit markup to derive the contract price. This protects the provider from unpredictable cost overruns or changes requested by the government).

[62] *Supra* note 4 at Article 1 ("shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, an shall be the province of all mankind").

[63] *Supra* note 3 (joint venture of Boeing Commercial Space Company (United States), Energia Rocket and Space (Russia), KB Yuzhnoye/PO Yuzhmash (Ukraine) and Kvaerner Maritime (Norway) provide launch services from a converted oil platform in the Pacific Ocean near the equator).

[64] The White House, *U.S. Space Transportation Policy* (2005).

and people in the near future. This technology holds the potential to make commercial space activity cost effective and predictable. The lack of these two qualities is the largest impediment to the commercial space sector today.[65]

The emerging space opportunities envisioned by AST progress over time as the enabling technology becomes available. This progress is described in five stages over three time periods. The five stages by which space technology is expected to develop are suborbital applications, space based utilities, resource and threat management, long duration/zero-g exploitation, and colonization. The three time periods projected for these stages are characterized as the year 2005 and beyond, year 2025, and 2025 and beyond. Development is predicted to progress as follows.[66]

Already underway, the first period begins with suborbital applications to permit adventure travel as planned by Virgin Galactic and RLV high-speed research and hardware qualification to perfect the transportation technology initiated through National Aeronautics and Space Administration (NASA) and United States Air Force (USAF) research. Simultaneously occurring are the perfection and expansion of space based utilities such as the present telecommunications, navigation, and remote sensing systems. Among expansions under consideration is the construction of a power generation system to transmit solar energy from orbit to earth as an independent source of energy.[67]

The second period is expected to occur by the year 2025 when space safety will become a critical factor in further development of human space activity. Safety technology will be critical to preserve the congested orbits for future use by mankind as the LEO is a finite area, thus a limited natural resource. The applications envisioned for this period include space debris management, hazardous waste disposal, natural resource acquisition, and asteroid detection and negation. Beyond the year 2025, after the foundational applications are perfected, AST predicts that space tourism, zero-g medical care, space manufacturing, and agriculture will become a reality.[68]

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[65] *Supra* note 55.
[66] *Supra* note 54 at c. 1.
[67] *Supra* note 43.
[68] *Supra* note 54.

Finally, the third period will begin with near space[69] settlements by humans, solar system exploration, and the development of new space sciences to create the follow on development not yet foreseen. AST's five phase development forecast from the present space applications to the colonization of space has a science fiction ring to it. But, assessing the state of the predicate technologies, our present reliance on space applications, and the rapidity of our advancement, this recurring prediction of space colonization is no longer such a distant capability.[70] As RLV technology becomes operational, the world's demand for space based global utilities will drive the expansion of existing applications and make possible these additional space applications.[71]

Although the realization of a true RLV is seen as the predicate to the developmental path outlined above, its immediate impact will be on commercial applications that are sensitive to price and predictability. These two qualities may cause the existing commercial space and government relationship to change. A more affordable deployment cost will increase the number of viable space applications. As launch risk is reduced and on-schedule space access is increased, the increased commercial demand may further reduce government activity. The effects of alternative revenue generating activities are speculative. But, commercial activity will increase a result of the RLV's introduction. Government space programs will remain a useful hedge against a space economy downturn. And, national defense and security projects will continue to fund high technical risks to maintain their edge. But the government's fundamental relationship will evolve as both regulator and customer to an international space industry adapting to new market opportunities. As in the aviation analogy, national prestige will motivate continued national or regional government engagement with space providers even in an increasingly commercial environment.

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[69] *Supra* note 3 (near space is the area extending from the *Karman line* at approximately 100 kilometers from the surface of the earth to the geosynchronous orbit at 36,000 kilometers).
[70] Wernher von Braun et al. "Man Will Conquer Space Soon!" *Collier's Weekly* (1952-1954) (series of space articles which popularized space exploration in the 1950s); *Supra* note 6.
[71] *Supra* note 54.

2. Space Safety

> [*I*]*t is essential that Member States pay more attention to the problem of collisions of space objects, including those with nuclear power sources, with space debris, and other aspects of space debris, calls for the continuation of national research on this question, for the development of improved technology for the monitoring of space debris and for the compilation and dissemination of data on space debris,… and agrees that international cooperation is needed to expand appropriate and affordable strategies to minimize the impact of space debris on future space missions.*
>
> - United Nations General Assembly Resolution 62/217

The issue of space safety can be summed up as protection against unintentional harms. The world's reliance on space warrants an examination of the risks inherent with space use. Space is unique because this international commons borders every state. Every state is expressly permitted to use space for its benefit and interest.[72] And, no state may assert a claim by sovereign right to any portion of space despite the great time and expense required to master this environment.[73] The result is that this newly accessible international commons benefits both governmental and private endeavors. In the span of fifty years, near space has become host to what is best described as space based global utilities. These utilities are unique in that their position allows unparalleled access and speed for the terrestrial user.

Commercial space activity is presently limited to near space; this term is used to describe the area extending from the earth's atmosphere outward toward the geosynchronous orbit, or between 100 kilometers[74] and 36,000 kilometers[75] above the surface of the earth.[76] The benefits of space based applications are their high vantage point with the earth. This allows spacecraft to view a large portion of the earth's surface, it does not require permission to fly over another state's territory, and once in orbit it remains on station so long as it has sufficient fuel to maintain the desired orbital position.

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[72] *Supra* note 4 at Article I.
[73] *Ibid*. at Article II.
[74] *Supra* note 3 (*Karman line* is located at an altitude of 100 kilometers above the earth's surface and marks the boundary between the atmosphere and outer space. It is named after Theodore von Karman, a Hungarian-American engineer and physicist who predicted its existence).
[75] *Ibid*. (*geosynchronous orbit* is located at an altitude of 36,000 kilometers above the earth's surface marks the point at which an object in orbit will maintain its relative position to a given point on the surface. This range marks the end of the *near space*, beyond which only scientific and exploration spacecraft travel.).
[76] *Supra* note 54.

Any discussion of supervision must first recognize the physical environment to be managed. Orbital mechanics are the rules which dictate the curved path an object under the gravitational influence of another body will follow. A naturally occurring example is the moon's orbit as a result of its attraction to the earth. Orbital mechanics are used by operators and space surveillance systems to predict with a high degree of certainty the position of an object along its orbital journey. However, over time the space environment affects an object's path and the resulting orbital decay eventually removes the satellite from its operational location. These environmental factors include atmospheric drag which eventually slows the space object which causes it to de-orbit. The combined influence of the gravitational pull of the earth, moon, sun and other celestial bodies affect the object's orbital path. Earth's irregular shape, geomagnetic field, and solar radiation also exert influence on space objects. The resulting perturbations cause a degree of unpredictability for the orbital path and require the satellite to carry fuel onboard to conduct station keeping maneuvers. These maneuvers are required periodically to nudge the satellite toward the center of its desired orbital position.[77] Also, the operator and other interested parties must monitor space objects to avoid conflicting orbital positions and frequency use.[78]

Orbital characteristics and constellation design may vary depending on the desired space application, but orbital mechanics limit the number of useful orbital planes and satellite positions along them for satellite operations. The first orbital characteristic is the orbital period, or the time it takes for an object to complete one revolution around the earth. This is a function of the object's distance from the center of the earth. The lower an object orbits the earth, the shorter the period must be to maintain its altitude. Therefore, low earth orbits may circle the earth every 90 minutes while the farthest near space satellites operate in the geosynchronous orbit with an orbital period of approximately 24 hours.[79]

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[77] Lawrence D. Roberts "A Lost Connection: Geostationary Satellite Networks and the International Telecommunication Union" (2000) 15 Berkeley Tech. L.J. 1095 at 1101 ("each satellite in GEO is usually kept in its position within an accuracy of approximately one-tenth of one degree").
[78] Department of Defense, *Joint Publication 3-14 Joint Doctrine for Space Operations* (2002) at Appendix F [as of 21 November 2007 this publication is under revision].
[79] *Ibid.*

The second characteristic is eccentricity, or how circular an object's orbital path is in relation to the earth. A perfect circle will maintain a near equal distance from the earth at all times since the earth is not perfectly round, whereas an elliptical orbit will cause the orbit to come nearer to the earth on one end and increase its altitude on the other end of the orbit. The point farthest from the earth's surface in the orbit is referred to as the apogee; the point closest to the earth's surface is the perigee.[80]

The third characteristic is inclination, or the angle between the earth's equatorial plane and the satellite's orbital plane. This angle determines what portion of the earth will pass under the object during its orbital period. A zero degree angle places an object over the equator. A ninety degree angle will travel over each polar region and cross the equator twice each orbit.[81]

Finally, orbital velocity is the speed required to establish and maintain an object in orbit. An object launched from west to east along the equator receives an extra boost from the earth's rotation to reach the escape velocity required to achieve orbit. Therefore, to minimize the amount of energy required to lift a payload to orbit, most satellites orbit the earth in what appears as a counter-clockwise direction when viewed above the North Pole. An orbit traveling from east to west, or a clockwise direction, is referred to as retrograde orbit.[82]

The commonly used orbits begin with the Low Earth Orbit (LEO). The LEO is the easiest orbit to reach and its close proximity to the earth provides the best imagery resolution and requires the least signal strength to communicate with the satellite, but it has the smallest field of view of the orbits. Also, the orbital life in LEO is shorter than higher orbits as the atmospheric drag is strongest on LEO. The applications normally associated with LEO are remote sensing, communications, and all manned space flight.[83]

The Polar Orbits are LEOs with a high inclination which takes the object over the polar regions which has the benefit of traversing the entire surface of the earth once each orbital period. A subset of polar orbit is the Sun Synchronous Orbit (SSO) in which the object maintains a constant orientation toward the sun during its orbital period. This

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[80] *Supra* note 3.
[81] *Supra* note 78.
[82] *Supra* note 3.
[83] *Supra* note 78.

allows the satellite to receive continuous exposure to the sun for solar power or continuously view an illuminated earth surface. The applications normally associated with Polar Orbits are remote sensing and weather. These services often entail a constellation of satellites to provide the desired level of persistence. The result of the coverage area, the relationship to the sun, and the use of constellations make this a highly congested orbit.[84] The LEO is the plane most in need of safety oversight as it contains all human space flight and will host RLV traffic in the near future. Also, it is most susceptible to harmful interference originating from the surface of the earth.

The Medium Earth Orbit (MEO) provides a larger field of view and longer orbital period to allow longer loiter time over a given point. The MEO is more difficult to reach but the orbital life is longer than LEO. The application normally associated with MEO is GNSS. This application requires large constellations to provide global coverage.[85] The MEO neither hosts human space flight nor suffers from the heavy congestion associated with the GEO. However, its GNSS application play an increasingly critical role.

The Geosynchronous Earth Orbit (GEO) is unique in that its period is equal to the earth's rotation or approximately 24 hours, and a zero inclination will position the object over the equator. However, if the object also has a zero eccentricity or circular orbit, this combination allows the object to remain over one spot on the earth at all times. This subset of GEO is referred to as Geostationary Orbit (GSO). The GEO/GSO coverage area is nearly one-third of the earth's surface and enjoys continuous coverage. However, it is the most difficult to reach and requires greater transmission power for signals to travel this great distance. And the unique relationship between a given GEO slot to a given region of the earth makes this the most congested of the orbits. The applications normally associated with GEO are communications, weather, and surveillance.[86] This orbital plane is the only one with specific slot allocations made by the supervising state.

The Highly Elliptical Orbit (HEO) or Molniya Orbit,[87] employs an elliptical orbit which produces a long coverage time on the high end of its orbit to serve a large coverage

[84] *Ibid.*
[85] *Ibid.*
[86] *Ibid.*
[87] *Supra* note 3 (named after the Soviet *Molniya* series of military communication satellites beginning in 1964 using an elliptical 12 hour orbit with a high apogee to produce a long dwell time over the northern hemisphere and requiring less energy than that required to reach GSO).

area for a portion of its orbital period. The benefit of HEO is extended coverage over the Northern Hemisphere not otherwise serviceable by GEO due to its angle from the equatorial plane to the North Pole. The applications normally associated with HEO include communications, remote sensing, and scientific research.[88] This orbital plane passes through the other less elliptical orbits.

Constellations, or multiple satellites, are required in order to provide continuous and/or global coverage. The number required depends on the altitude, angle to service area, signal strength, capacity, and requirement for spares. The inclination is the key to determining whether a single satellite can cover the required service area or whether a constellation of satellites is required. Therefore, a Polar Orbit may provide global coverage and the GEO may provide continuous coverage. But to obtain both qualities, a constellation is required. Additionally, some applications require a combination of orbits to provide the necessary coverage.[89]

Once in space, communication with the spacecraft to control its flight or to perform its function requires a reliable radio frequency assignment. Electromagnetic radiation travels at nearly the speed of light and is extremely useful in communicating at great distances. However, the background of natural emissions from space and the use of radio frequencies on earth interfere with satellite transmissions. And, not all bands are equally suitable for space communications as some frequencies are more readily absorbed by the earth's atmosphere. Unlike physical collisions, radio frequency interference occurs when the same band segment is used, signal strength is excessive, or one satellite blocks another's transmission to or from earth. Therefore, careful management of the usable spectrum to avoid interference with space applications is required and must occur globally to be effective. The coordinated assignment of radio frequency band segments and the assignment of orbital positions make satellite operations possible. The advent of digital communications and the hope of future technologies such as communication by laser will increase the capacity of space communications. Like orbital mechanics, radio frequency spectrum management is

[88] *Supra* note 78.
[89] *Ibid.*

fundamental to understanding the space environment.[90] Therefore, the most efficient use of this resource is necessitated in order to maximize the utilization of space by all applications.

The risk of physical collision is increasing. NASA's Orbital Debris Program Office reports three collisions detected between 1991 and 2004.[91] And, it has detected 194 known fragmentations and 51 anomalous events of objects on orbit since 1961.[92] Satellites and manned spacecraft share near space with an estimated 35 million pieces of space debris greater than one centimeter in size. Of these, approximately 14,000 objects are larger than ten centimeters, making them large enough to be tracked. In addition, the United Nations registry contains only 5,660 entries by the member states.[93] Spacecraft are presently designed to withstand the impact of objects less than one centimeter in diameter. Therefore, the hazard presented by items too small to track, but large enough to damage seriously or destroy a spacecraft is a precarious one.[94]

Unfortunately, the year 2007 was the worst year for space debris creation in the space age with 10 fragmentation events identified. The worst of these was the satellite breakup in January 2007 when the Fengyun-1C[95] was deliberately destroyed in an anti-satellite (ASAT)[96] test conducted by the People's Republic of China in the LEO, at approximately 850 kilometers above the earth. This satellite weighing nearly one metric ton broke up spreading 2,600 traceable items of debris throughout the LEO representing a 20 percent increase in tracked debris.[97] It is estimated that this one event created 150,000

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[90] National Aeronautics and Space Administration Jet Propulsion Laboratory, *Basics of Space Flight* (1 September 2003) online: Jet Propulsion Laboratory <http://www.jpl.nasa.gov/basics/>.
[91] National Aeronautics and Space Administration, *Orbital Debris Quarterly News*, Volume 12, Issue 1 (January 2008).
[92] ___. *Orbital Debris Quarterly News*, Volume 12, Issue 2 (April 2008).
[93] United Nations Office for Outer Space Affairs, *Registry Search* online: Office for Outer Space Affairs <http://www.unoosa.org/oosa/showSearch.do> (accessed on 24 April 2008).
[94] *Supra* note 54.
[95] See especially William J. Broad, "Orbiting Junk, Once a Nuisance, Is Now a Threat" *The New York Times* (6 February 2007).
[96] *Supra* note 3 (a satellite or other device whose purpose is to disable an enemy satellite by physical destruction or interference).
[97] See also Thom Shanker, "Missile Strikes a Spy Satellite Falling From Its Orbit" *The New York Times* (21 February 2008) (in 2008 the United States fired a missile at a satellite in order to disperse hazardous material; the shoot down took place in low LEO where debris would not conflict with other space operations and would decay in weeks).

pieces of debris exceeding one centimeter in size and its location in LEO is particularly worrisome as all manned space activity occurs in this orbit.[98]

Manmade debris has been placed into near space at an alarming rate. The United States' Space Surveillance Network maintains a satellite catalog of objects entering and de-orbiting the near space environment. Additionally, on orbit explosions of discarded rocket stages containing residual fuel decades after their launch is further increasing the debris risk. This growing body of satellites (operational and dead), rocket bodies, fragmentation, rocket fairings, space station trash, etc. has necessitated debris mitigation measures as adopted by responsible space faring states in an effort to reduce the debris growth rate. However, the cascading effect of collisions in these finite orbital planes places whole segments of near space at risk of becoming unusable. Once an orbital plane is too cluttered to operate safely, there is no present capability to remediate the area and it is estimated that any future capability will be prohibitively costly. All but the lowest LEO positions will retain their debris for years, decades, centuries, and millennia, with the highest altitudes such as the heavily congested GEO having the longest duration.

The satellite catalog data is useful for conducting studies to predict the future near space environment. Studies undertaken prior to the disastrous increase in 2007 conclude that even if no additional launches occur after the year 2004, near space debris will actually increase even after taking into account the natural decay of debris resulting in de-orbit. NASA's LEO-to-GEO Environment Debris (LEGEND) model produced a three-dimensional model of the near space environment for the next 200 years by simulating only ten centimeter and larger debris populations in LEO. The model revealed the overall debris level will be maintained by collision fragments replacing the decayed debris through the year 2055. Beyond 2055, the creation of new collision fragments will exceed the number of decaying debris to increase the net debris level.[99]

Therefore, the current debris population in the LEO region has reached the point where the environment is unstable and collisions will be the most likely debris generating mechanism in the future. [100] However, the debris risk is already present as documented

[98] *Supra* note 92.
[99] J. C. Lou and N. L. Johnson, "Risks in Space from Orbiting Debris" *Science* (20 January 2006).
[100] *Ibid.*

by collisions with the Space Shuttle,[101] Hubble Space Telescope,[102] and Mir Space Station.[103] The space surveillance systems employed by the United States do not provide a comprehensive view of space. Therefore, it relies on predictive analysis to project collision risks. Satellites have only limited maneuver capability if any and when performed it reduces its useful life. Despite these dangers, the technology to remove debris from orbit is not available and the current proposals are prohibitively expensive.[104]

Improvement in SSA and frequency management will allow smaller intervals between orbital slots to increase the capacity of the most congested orbital planes. But, the additional cost required to reduce debris creation, collision prevention, and spectrum efficiency are born by the individual operators. Meanwhile, the space environment remains permissible enough that the risk realized today by the space operator does not warrant such investment when examined in purely economic terms. However, the long term risk to space applications requires immediate action to reduce these hazards as we reach the point of overwhelming a vital segment of an orbital plane without realizing we have passed the point of no return. In order to protect the greater space community, all space activity must reduce the collective risk individual business decisions impose on future space access.[105]

[101] Hauck, Frederick H., et al., "Protecting the Space Shuttle from Meteoroids and Orbital Debris" (Washington: National Academy Press, 1997). (window strikes reported since 1983, multiple strikes on orbiter and payload exceed the level of risk for the original design).
[102] Penetrations: 1993 antenna and 2005 solar array.
[103] Penetration: 1991 solar array.
[104] "Bureaucracy Threatens Sat Protection Project" *Aviation Week* (4 April 2008).
[105] Andrew C. Revkin, "Wanted: Traffic Cops For Space" *The New York Times* (18 February 2003).

3. Space Security

> *The war with Iraq was the first conflict in history to make comprehensive use of space systems support. All of the following helped the Coalition's air, ground, and naval forces: The DMSP [Defense Meteorological Support Program] weather satellites; US LANDSAT [land satellite] multi-spectral imagery satellites; the GPS; DSP early warning satellites; the tactical receive equipment and related applications satellite broadcast; the Tactical Information Broadcast Service; as well as communications satellites.*
>
> - DoD Report to Congress on the Conduct of the Persian Gulf War

Space security, on the other hand, is best described as those actions necessary to protect near space from intentional harmful acts. The global economy and the national security apparatus rely heavily on the space applications described. The specific commercial advantages were chronicled above, but the military is equally dependent on space applications for global access,[106] perhaps to a degree that would surprise many within the military.[107] The fact that there are no geographical boundaries and no terrestrial obstructions or limitations in space gives military forces the ultimate high ground. As in all environments, militaries must identify the key terrain before the battle in order to protect its use by friendly forces and deny its use by the adversary.[108] The growing dependence on space based capabilities creates a corresponding vulnerability that could be exploited by an adversary. Potential adversaries recognize the relative advantage the use of space confers upon the United States and other modern societies, and they will seek to diminish or match this advantage in future conflicts.[109]

Although the UN Charter declared the use of force is no longer a recognized means to accomplish a political end, the past 60 years have demonstrated its failure to guarantee the peace for any but those capable and prepared to defend their peace. Since the end of the Cold War, the destabilizing regimes tend also to resist integration with the global economy.[110] Yet they now obtain the ability to degrade space applications through

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[106] Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress* (1992).
[107] United States Congress, *Commission to Assess United States National Security Space Management and Organization* (2001) [*Rumsfeld Report*].
[108] *Supra* note 78.
[109] Department of Defense, *Military Power of the People's Republic of China: A Report to Congress Pursuant to the National Defense Authorization Act Fiscal Year 2000* (2008).
[110] *Barnett, supra* note 41.

jamming or other techniques designed to diminish the asymmetrical advantage enjoyed through commercially available technology.[111] Or, they gain access to space through the international marketplace to obtain comparable advantages while striving to develop independent access to space.[112] Unfortunately, the traditional space security concerns have survived the end of the Cold War with the Chinese ASAT test[113] validating the worst fears of what harmful potential hostilities in space may bring.[114] Space applications are critical to maintaining the peace through strategic intelligence on potential adversaries and as the "national technical means" to verify treaty compliance.[115] And the vulnerability is not limited to the space segment; the ground segment and transmissions between the two require an ability to detect, attribute, and respond to such threats.

The responsibility to provide pre-launch warning, track boosters during flight, and provide post-launch assessments to determine their impact are central to security. Currently, the ICBM launch notification and tracking systems provide a limited space surveillance capability today. This system is not capable of tracking all items large enough to present a threat to spacecraft through an accidental or intentional collision. Surveillance is particularly vulnerable to objects in the southern hemisphere which did not generate this Cold War infrastructure. The advent of nanosatellites presents a new threat by reducing the cost of development and deployment for rogue states and the added challenge of tracking such satellites in orbit. These trends produce a challenging environment to identify security risks to the space infrastructure and to make the distinction between natural, accidental, and intentional acts difficult to distinguish.

The first critical component of space security is space situational awareness (SSA). Currently, the Air Force Space Command catalogs approximately 14,000 objects in space as small as a baseball in LEO to a basketball in GEO.[116] The legacy SSA system

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[111] See e.g. Siavosh Ghaz, "Iran Jams TV Channels" *The Courier Mail* (7 June 2005).
[112] See e.g. Covault, Craig, "Iran Set to Try Space Launch" *Aviation Week & Space Technology* (25 January 2007).
[113] *Supra* note 95.
[114] Michael J. Coumatos, William B. Scott & William J. Birnes, *Space Wars, The First Six Hours of World War III* (New York: Tom Doherty Associates, LLC., 2007).
[115] *Supra* note 78.
[116] Michael Hoffman, "Air Force To Launch Space Based Space Surveillance System" *Defense News* (10 April 2008).

of the United States and Russia predicts conjunction points between objects with a wide margin of error. This makes the present predictive analysis between the operator's satellite and the known conflicting objects of questionable value. The danger of maneuvering to avoid a predicted conjunction point carrying a low probability of impact is often outweighed by the cost of fuel (lifetime), loss of service, and danger of maneuvering into an unpredicted collision.

The goal of creating a space picture akin to what air traffic managers enjoy will be costly when considering the vastness of the near space environment. The United States plans to launch a Space Based Space Surveillance (SBSS) system to monitor satellites in GEO later this year. Until then, it must rely on the present Ground-based Electro-Optical Deep Space Surveillance. This system allows only limited observation, whereas the satellite system will allow continuous SSA of the most congested orbit.[117]

Further complicating space security is the use of commercial satellites by militaries to assist in governmental and belligerent activities. Use of a neutral state's commercial remote sensing or telecommunication satellites to perform military operations is necessitated by the great demand for these limited resources during armed conflict. More troubling will be the unauthorized use of GNSS services for combat activities which may place a neutral state's space resources at risk as a military target. The blurring of civilian and military status of satellites provides new legal challenges for governments and business alike.

In conclusion, this chapter has reviewed the circumstances giving rise to the continuing supervision requirement for non-governmental space activity during the Cold War and the evolving role space applications play in the current global economy. Three trends are identified: the need to address an increasingly independent commercial space sector, a finite near space environment, and the enduring need to secure access to ever indispensible space applications. The next chapter will examine the international obligation to supervise national activities and the standards adopted by the international community.

[117] *Ibid.*

II. INTERNATIONAL OBLIGATION TO SUPERVISE

> *State Parties to the Treaty shall bear international responsibility for national activities in outer space … whether carried on by governmental agencies or by non-governmental entities … .*
>
> -*Outer Space Treaty*, Article VI(1)

The general consent of states creates rules of general application.[1] More particularly, the *Statute of the International Court of Justice* provides the following hierarchy for determining international obligations: international conventions establish rules when recognized by the contesting states; international custom as evidenced by general practice; general principles of law recognized by civilized nations; and subsidiary means such as judicial decisions and teachings of the most highly qualified publicists.[2] The law of international responsibility or the obligation of continuing supervision of national space activities contain all four of the sources relied upon by the International Court of Justice (ICJ).

State responsibility is a general principle established in public international law which occurs upon the breach of a convention, treaty, or other legal duty. Although it has no treaty, the duty to make reparation in an appropriate form flows from the breach of such a duty.[3] The form depends on the terms of the obligation and the factual circumstances but may include payment of actual damages or assurances of non-repetition. This duty may even arise from the consequences of an act that is not itself unlawful,[4] such as the duty of the launching state to pay damages resulting from its national space activities.[5] Reparations are long recognized as a method to address noncompliance with international obligations not resulting in any particular form of damage, but rather to compel compliance in order to preserve the state's interest. Reparation is such an essential mechanism to enforce a convention or treaty term that its

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[1] Ian Brownlie, *Principles of Public International Law* (Oxford and New York: Oxford University Press, 2003) at 3.
[2] *Statute of the International Court of Justice*, 26 June 1945, 59 Stat 1031, 3 Bevans 1179 at Article 38.
[3] Yearbook of the International Law Commission 2001 Volume II (Part Two), *Report of the Commission to the General Assembly on the work of its Fifty-third Session*, UN ILC, 2001, UN Doc. A/CN.4/SER.A/2001/Add.1 (Part 2) [*Responsibility of States for Internationally Wrongful Acts*].
[4] *Ibid.* at Article 55.
[5] *Treaty Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, 610 U.N.T.S. 205, 18 U.S.T. 2410 [*Outer Space Treaty*] at Article VII; *Convention on the International Liability of Damage Caused by Space Objects*, 29 March 1972, 961 U.N.T.S. 187, 24 U.S.T. 2389 [*Liability Convention*] at Articles II and IV.

power is implied. Therefore, a specific reparation provision is not required to be included in the agreement to be available.[6]

The concept of state responsibility is based on either original or vicarious responsibility. A state has original responsibility for its own acts or the acts it authorized. Vicarious responsibility is the consequence of unauthorized acts of a state's agent, a national, or an act within its territory.[7] A State Party to the *Outer Space Treaty* consequently incurs original responsibility for the commercial space activities conducted pursuant to its formal authorization process. It may also be found vicariously responsible for the unauthorized space activities of its nationals or acts occurring within its territory. However, the attribution of commercial activity occurring in space under the control of a national or originating from its territory is challenging for the international community to assess.[8]

Whether a person, entity, or property is appropriately attributed to a state is normally a function of its domestic jurisdictional laws. This domestic law is to be recognized by other states so far as it is consistent with the applicable treaties and international customs.[9] The space treaties specifically attribute space activity through launch[10] and registration.[11] The state who launches, procures the launching, or from whose territory or facility an object is launched is deemed responsible.[12] The state of registration obtains jurisdiction over the object and personnel while in space.[13] In so doing, this regime attempts to apply the principle of substantial connection through its designation of the launching and registration states.[14] However, in a commercial environment in which capital, both physical and human, are exchanged in an international market, these connections, though closely aligned with authorization, are not necessarily applicable through the supervision stage of the space activity. The initial responsible

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[6] *Supra* note 1 at 421.
[7] *Supra* note 3 at Part One, Chapter II.
[8] *Supra* note 1at Part VIII.
[9] *Ibid.* at 377.
[10] *Outer Space Treaty*, s*upra* note 5 at Article VII; *Liability Convention*, s*upra* note 5 at Article I(c).
[11] *Outer Space Treaty*, *supra* note 5 at Article VIII; *Convention on the Registration of Objects Launched into Outer Space*, 12 November 1974, 1023 U.N.T.S. 15, 28 U.S.T. 695 [*Registration Convention*] at Article II.
[12] Bin Cheng, "Article VI of the 1967 Space Treaty Revisited: *International Responsibility*, *National Activities*, and *the Appropriate State*" (1998) Journal of Space, Law Volume 26, Number 1.
[13] *Ibid*.
[14] *Supra* note 1 at 395.

state may not retain the ability to supervise if it lacks jurisdiction over the acquiring entity even if the *Outer Space Treaty* preserves the jurisdiction link. This gives rise to the question of which state has the real and effective nationality.[15]

The growth of space faring states[16] calls into question the ability to provide adequate supervision. Originally, space faring states possessed a monopoly on space technology and launch facilities. The potential now is that commercial activity may arise in jurisdictions which possess little capability or desire to provide supervision. What is yet more disturbing is that such a jurisdiction may not be a party to the *Outer Space Treaty*, thus not extending original responsibility over its commercial space activities. What remains for the responsible space faring states are their own long arm statutes in an attempt to reach some aspect of the commercial actor and negotiations with the sponsoring state. Either approach may prove inadequate to the threat posed by irresponsible behavior in space calculated to maximize short term gains even at the cost of the larger international community's interest in preserving space access. Such are the dangers that flags of convenience or registrations of convenience create for the space environment.[17]

These treaties have no formal dispute settlement authority to determine the responsible state.[18] Unfortunately, the ICJ decisions factually based in the analogous sea environment confound the issue of attribution. In the *Corfu Channel* case the court concluded from the mere fact of the control exercised by Albania over its territorial waters that it was responsible for any unlawful act perpetrated therein, specifically the presence of an underwater mine.[19] Whereas, in the *Oil Platform* case it refused to attribute underwater mines and missile attacks by Iran against international shipping despite the physical and circumstantial evidence tying it to these acts of aggression.[20] In space, the attribution of objects and their activities are more difficult to assess; as stated

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[15] *Nottebohm Case (Liechtenstein v. Guatemala)*, [1955] I.C.J. Rep. 4.
[16] Project Ploughshares, *Space Security 2007* (Waterlo: Project Ploughshares, 2008).
[17] Inter-Agency Debris Coordination Committee, *IADC Space Debris Mitigation Guidelines* (2004), online: Inter-Agency Space Debris Coordination Committee <http://www.iadconline.org/> [*IADC Guidelines*].
[18] But see, *Liability Convention*, *supra* note 5 at XIV – XX (authority to establish an ad hoc claims commission).
[19] *Corfu Channel Case (United Kingdom of Great Britain and Northern Ireland v. Albania)*, [1949] I.C.J. Rep. 4.
[20] *Case concerning Oil Platforms (Islamic Republic of Iran v. United States of America)*, [2003] I.C.J. Rep. 161.

earlier there are an estimated 35 million space objects[21] capable of damaging severely or destroying a satellite while only 5,660 objects[22] are formally acknowledged by the states to the United Nations.

Finally, the creation of binding space law outside the limited mandate of ITU has been stalled by the lack consensus among the major space faring states. UNCOPUOS has not produced a convention since the adoption of the *Moon Treaty* in 1979. CD is effectively blocked by a lack of consensus on how to proceed with fashioning an effective limitation. The United States is the most vocal detractor for a new space arms control agreement. Its position is based upon the practical challenges presented in defining such space weapons when most operable satellites have the inherent capability to disable or destroy neighboring satellites. Should the definition dilemma be solved, the inability to verify compliance with such a treaty remains. And, the present focus on the space segment, while ignoring the present ground based threats to space applications and the vulnerability of ground segment and transmission, are outside the scope of this debate.[23] Therefore, the United States opposes the development of new legal regimes which prohibit or limit access to or use of space. Proposed arms control agreements or restrictions are not supported which impair the right to conduct research, development, testing, and operations or other activities in space for national interests.[24]

Therefore, international organizations and bodies of space experts frequently conduct conferences in an effort to advance this body of law through nonbinding processes. Upon the consensus of the participants, resolutions, declarations, or principles are published as formative instruments to influence future space law development. The resulting documents adopted by the interested commercial sector, governments, space administrations, or other international organizations are collectively referred to as "soft" law. The hazard of "soft" law pronouncements is the false impression of substantive law they present when authors and advocates attach unwarranted weight to their text. This is troublesome in the arena of public international law where ascertaining the applicable

[21] National Aeronautics and Space Administration, *Orbital Debris Quarterly News*, Volume 12, Issue 2 (April 2008).
[22] United Nations Office for Outer Space Affairs, *Registry Search* online: Office for Outer Space Affairs <http://www.unoosa.org/oosa/showSearch.do> (accessed on 24 April 2008).
[23] Paul A. DeSutter, "Is An Outer Space Arms Control Treaty Verifiable?" (George C. Marshall Institute Roundtable at the National Press Club, 4 March 2008).
[24] The White House, *U.S. National Space Policy* (2006) [Unclassified].

formal and material sources of law to a particular state in question requires careful attention.[25] The key to evaluating the authority of documents short of convention law is to evaluate its acceptance by the major space faring states, the reputation of the contributing publicists, and the evolving state practice. The proper perspective is to view "soft" law as declarations of collective wisdom of the contributing space stakeholders. Over time they may correctly predict the evolved consensus on the question they address. And, a state may implement a particular practice in its own domestic law when useful to exercise its supervision obligation and even encourage the implementation by others. But without the general consent of the state to be bound, such documents fail to become "hard" law, or binding obligation.

A. OUTER SPACE TREATY

> *The activities of non-governmental entities in outer space … shall require authorization and continuing supervision by the appropriate State Party to the Treaty.*
>
> -*Outer Space Treaty*, Article VI (2)

The purpose of the *Outer Space Treaty* was to establish general principles to be applied prospectively to govern space activity. Authors describe it as the *Magna Carta* or the constitution of space law. This Treaty is the most widely accepted of the five space law agreements[26] creating binding legal obligations for the State Parties. Some of these principles are judged to now constitute customary international law applicable to parties and non-parties alike as they have become so widely accepted by the international community. However, the *Outer Space Treaty* Article VI obligation to provide supervision is not one of these. But, its more general principle of state responsibility as outlined above is a well established principle in the body of public international law.

The space law regime is a specialized area of international law, thus when interpreting these agreements one must be mindful that some of its principles differ from general international law norms. Space is a newly regulated international commons

[25] *Supra* note 1 at c. 1; Eilene Galloway, "Creating Space Law" *Space Law-Development and Scope* (1992).
[26] *Outer Space Treaty* with 98 State Parties, *Rescue Agreement* with 88 State Parties, *Liability Convention* with 82 State Parties, *Registration Convention* with 45 State Parties, and *Moon Agreement* with 11 State Parties (*Moon Agreement* is not accepted by any State with a lunar program).

which shares similarities, as well as dissimilarities, with the terrestrial international commons whose accompanying bodies of law were developed over time to reflect their usage. Space law's rapid development in a complex environment, occurring during a contentious period, did not benefit from the observance of long established state practice as other international commons benefitted prior to promulgating their conventions.[27] As technology grows to permit new space applications and the evolving field of space actors change, this international commons will require an evolving legal structure to remain relevant.[28]

Briefly, the well accepted principles of space law include the principle of common interest. Found in the first sentence of Article I, this principle recognizes the most pragmatic difference between space and other international commons by recognizing that it borders every state and by declaring it a natural resource for all states to enjoy and respect. The following sentence establishes the complementary principle of freedom by expressing that states are free to explore and use space in accordance with international law. Article III reaffirms the application of international law to space activity in recognizing that space activities affect the entire international community, not just the supervising state. However, it is important here to recall that international law differs from state to state. And, Article IX requires a State Party to conduct international consultations prior to conducting activities with potential for harmful interference with the activities of other Parties. Although this provision is limited to the *Outer Space Treaty* Parties, it finds widespread observance and implementation through the larger body of ITU Member States.

The obligation to authorize and supervise commercial activity is found in Article VI of the *Outer Space Treaty.* As adopted from the earlier *Declaration of Legal Principles Governing the Activities of States in Outer Space (1963)* and reaffirmed by the *Resolution on the Application of the concept of the "Launching State"(2004),* it recognizes a fundamental change to the prevailing international law by redefining national activities to include both government and non-government actors in space. This

[27] See e.g. *United Nations Convention on the Law of the Sea*, 10 December 1982, 1833 U.N.T.S. 3, 12 I.L.M. 1261 [*Law of the Sea*].
[28] Manfred Lachs, *The Law of Outer Space: An Experience in Contemporary Law-Making* (Leyden: A.W. Sijthoffat, 1972) at c. III.

shift brings the actions of the state's commercial sector within the original responsibility of the appropriate state rather than the more remote category of vicarious responsibility.[29] The liability provision in Article VII holds the state internationally liable for damage caused by national space activity wherever the damage may occur.[30] In the English text, separate terms are employed to distinguish the concept of *responsibility* from that of *liability*. The Treaty in other languages[31] loses this distinction by employing the equivalent term for the more general concept of *responsibility* in both articles. A State Party assumes responsibility for the harm caused by its commercial space activity. Conversely, a non-Party may be vicariously liable if it fails to use due diligence in accordance with the prevailing international standard to prevent harm committed by its nationals or from its territory. Such standards are established over time through the practices of the space faring states.[32]

The elimination of the public versus private distinction for the State Parties necessitates the appropriate state provide continuing supervision over its commercial activity in order to provide assurance to the other Parties that all space activity is conducted in accordance with the principles of the *Outer Space Treaty*. State Parties are to ensure its space activities comply with the Treaty, recognize international law as it applies to the state, and to both authorize and supervise its non-governmental activities. It is understood that states authorize and supervise governmental activity as it funds and directs the activities of national space programs. In contrast, non-governmental or commercial undertakings are normally neither explicitly authorized nor directly supervised by the national government. Therefore, the Treaty adds these additional requirements for commercial activity to assure other State Parties a regulatory void does not excuse negligence or mischievous acts by the nationals of another Party.

The duty to authorize ensures the state recognizes the activity about to be undertaken by a commercial entity through an a priori licensing procedure. This process requires the proposed operator to provide the authorizing department or agency sufficient

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[29] *Outer Space Treaty, supra* note 5 at Article VI ("State Parties to the Treaty shall bear international *responsibility* for national activities in outer space").
[30] *Ibid*. at Article VII ("internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies").
[31] *Ibid*. at Article XVII ("English, Russian, French, Spanish and Chinese texts are equally authentic").
[32] *Supra* note 12 at 11-12.

information to base its decision to either grant or deny the operator's request. Whereas, the continuing supervision duty ensures the national activity remains in compliance with the state's *Outer Space Treaty* obligations. A regulating body may either directly observe an activity or rely on reports from the operator, or a third party, to determine compliance. However, the Treaty does not provide minimal standards or procedures to satisfy this requirement. Therefore, individual states determine the form and scope of authorization and supervision required for their national activities in space. Consequently, the degree of regulatory oversight varies greatly by state. But as states commercialize their space operations, the trend has been to increase regulatory requirements as private activity becomes more independent of daily governmental involvement.[33]

The substantive provisions of the Treaty to be enforced through supervision include the principle of non-appropriation of space or celestial bodies,[34] space activities subject to international law,[35] restraints on permissible security measures,[36] requirements to render assistance to fellow space travelers,[37] avoidance of harmful interference with others use of space,[38] and compliance to inspection of all space facilities.[39] Article III's recognition of international law opens the door to a great number of international obligations to the continuing supervision requirement. These requirements in addition to those each state imposes to satisfy its own domestic interests provide the foundation for authorization and supervision of regulatory regimes.

By its nature, continuing supervision is applied extraterritorially as the nationals or object operates beyond the territorial boundaries of the appropriate state's airspace.[40] Additionally, the ground segment normally requires extraterritorial sites to communicate with the orbiting spacecraft. Each state creates and exercises its extraterritorial jurisdiction in accordance with its constitution or national legal charter.[41] Unlike the

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[33] Ram Jakhu, *Government Regulation of Space Activity Lecture Notes* (Faculty of Law, McGill University, 2008).
[34] *Outer Space Treaty*, *supra* note 5 at Article II.
[35] *Ibid*. at Article III.
[36] *Ibid*. at Article IV.
[37] *Ibid*. at Article V.
[38] *Ibid*. at Article IX.
[39] *Ibid*. at Article XII.
[40] Susan J. Trepczynski, *Edge of Space: Emerging Technologies, The "New" Space Industry, and the Continuing Debate on the Delimitation of Outer Space* (LL.M. Thesis, McGill University Institute of Air and Space Law, 2006) [unpublished].
[41] See e.g. 18 U.S.C. § 7.

aviation analogy, there is no international organization to implement the *Outer Space Treaty* such as the International Civil Aviation Organization (ICAO)[42] which implements the *Chicago Convention*.[43] Therefore, national governments lack the generally agreed upon international standards such a body generates[44] for adoption by the state's rulemaking apparatus.[45] Such an organization is not precluded by the Treaty. In fact, its prospective nature caused the drafters to employ broad principles to support the growth of space activity as this forum matures. One example of an international space organization is found in the *Moon Agreement*.[46] Although it failed to receive acceptance by the major space faring nations, Article 11(5) of the agreement provides for the establishment of an international regime and the appropriate procedures to govern the exploitation of the moon whenever such activity becomes feasible. A supervision standard setting body or procedures must not conflict with the principles of the *Outer Space Treaty*. But, presently the international community lacks consensus to form a new international body or to expand the mandate of an existing body, to establish such standards.[47]

In summary, Article VI supervision is without explicit and binding standards. However, the supervision obligation is bolstered by separate obligations to insure against space damage, register spacecraft, regulate radio transmissions to and from space stations, and prevent rogue acts. Nonbinding standards address export controls and debris mitigation. The evolving state practice with regard to these aspects of state supervision over time may reflect the international norm for space activities. But today, the state practice varies greatly and compliance with the limited binding and nonbinding standards do not enjoy universal application. Therefore, there exists an obligation to

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[42] International Civil Aviation Organization, online: International Civil Aviation Organization <http://www.icao.org> (ICAO is a specialized agency of the United Nations, located in Montreal, Canada).
[43] *Convention on International Civil Aviation*, 7 December 1944, 61 U.N.T.S. 1180, 61 U.S. Stat. 1180 [*Chicago Convention*].
[44] *Ibid*. at Article 37.
[45] *Ibid*. at Article 38.
[46] *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 18 December 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 [*Moon Agreement*].
[47] Nicholas Bahr *et al*., "ICAO for Space" (Draft white paper for the International Association for the Advancement of Space Safety, 2007) [unpublished]; Corinne Contant-Jorgenson *et al*., "Cosmic Study on Space Traffic Management" (Paper prepared for the International Academy of Astronautics, 2006); William Marshall *et al*., "Space Traffic Management" (Paper presented by International Space University summer session at Beijing, 2007).

supervise but states are left to implement this general obligation as they determine best. To date, this author is unaware of any complaint or démarche against a state for failure to satisfy their obligation to supervise.

B. LIABILITY CONVENTION

> *The term "launching State" means: (i) A State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space object is launched.*
>
> -*Liability Convention*, Article I (c)

Article VII of the *Outer Space Treaty* and the subsequent *Liability Convention*[48] does not require implementation legislation to fulfill its obligation to become internationally liable for damage by space objects. By acceding to either or both of these agreements, the launching state incurs liability for the damage caused by its commercial launch sector. However, requiring launch insurance equal to the magnitude of probable loss by the commercial entity seeking to launch or operate a space object is a responsible practice to speed recovery and ensure that a compensation fund is readily available for claimants. This is especially valuable for small states or for those liable for an entity whose proposed space application involves an elevated risk. However, states do not require continuing operational coverage as this portion of the space activity has not resulted in the same degree of risk that launch activities entail. But space activity does impose some risk on any surface area below its orbit.[49] In addition, the space segment[50] also risks collision, debris creation, and radio frequency interference[51] thereby placing other space objects at risk.

The majority view on liability differs depending on the space application involved. Liability for telecommunication satellites receives a generous view from the international community which recognizes no responsibility toward the users for claims

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[48] *Liability Convention*, *supra* note 5.
[49] *Ibid*. at Article II (absolute liability); See e.g. *Settlement of Claim between Canada and the Union of Soviet Socialist Republics for Damage Caused by "Cosmos 954"* (Released on 2 April 1981).
[50] *Ibid*. at Article III (fault liability); Contra (no claim filed as of the date of this writing).
[51] *Constitution of the International Telecommunications Union*, 22 December 1992, 1825 U.N.T.S. 31251 [*ITU Constitution*] at Article 44.

of damages resulting from its signals.[52] Commercial remote sensing activities under the prevailing view extend responsibility for the collection, dissemination, and use of remote sensing data to the operating state.[53] And, Global Navigation Satellite Systems (GNSS) under the majority view would assign liability to the provider states for any damage resulting from the loss or error of such signals,[54] whereas the provider states, the United States and the Russian Federation, take the position that liability for this free service which no state is obliged to use is limited to physical impact under their interpretation of the *Liability Convention*.[55]

As the RLV introduces space transportation to the international scene, the aviation analogy may be useful in addressing the new risk of passenger liability. States regulate aviation liability with respect to passengers and cargo through the *Warsaw Regime* and *Montreal Conventions*.[56] These regimes have their imperfections, but the introduction of a new space application will generate additional liability issues.

C. REGISTRATION CONVENTION

> *Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry.*
>
> -*Registration Convention*, Article IV(1)

The need to identify objects in space and to attribute state responsibility for such objects was first recognized through a resolution at the United Nations in 1961.[57] Toward this end, the United Nations public registry was established and registration commenced in 1962 with the United States providing the first two notifications.[58] The

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[52] *Ibid.* at Article 36.
[53] *Principles Relating to Remote Sensing of the Earth from Outer Space*, GA Res. 41/65, UN GAOR, 41st Sess., UN Doc. A/RES/41/65 (1986) 115.
[54] Jiefang Huang, "Development of the Longer-Term Legal Framework for the Global Navigation Satellite system" (1997) 22 Annals of Air & Space Law 585.
[55] Paul B. Larsen, "GNSS International Aviation Issues" (1998) 98 IISL 183.
[56] *Convention for the Unification of Certain Rules Relating to International Carriage by Air*, 12 October 1929, 137 L.N.T.S. 11, 49 U.S. Stat. 3000 [*Warsaw Convention, as amended Warsaw System*]; *Convention for the Unification of Certain Rules for International Carriage by Air*, 28 May 1999 [*Montreal Convention*].
[57] *International co-operation in the peaceful uses of outer space,* GA Res. 1721 (XVI), UN GAOR, 16th Sess. (1961) 6 [*Establishing the United Nations Registry of Launchings*].
[58] *Supra* note 22.

Registration Convention[59] was not adopted until 1974, making this practice a binding obligation for the Parties. The agreement received less support than the three previous space agreements[60] although its purpose was to refine the obligation found at Article VIII of the *Outer Space Treaty* and to complement the purposes of the *Liability Convention* and *Rescue Agreement*.

Each state is to maintain a registry of the objects it launches into orbit.[61] When two or more launching states are involved, they are to determine which state is to register the object.[62] The registration report is due to the United Nations as soon as practicable with the four orbital parameters: nodal period, inclination, apogee, and perigee.[63] This data is not known until the object reaches its orbital location; therefore, notification does not occur until sometime after the launch. To fulfill this requirement, states must require the commercial operators to provide them the orbital data once determined after launch. However, the usefulness of this data is short lived as it is outdated as a result of maneuvers made by the spacecraft and the perturbations resulting from the influence of natural forces on the object in orbit. There is no requirement to update the orbital parameters after the initial registration.

The state responsible for registration is the launching state.[64] The launching state definition[65] is the same as that found in the *Outer Space Treaty*[66] and *Liability Convention*.[67] The act of registration determines the jurisdiction applicable to the crew and spacecraft. This attributes the resulting activity to a particular state although multiple states or no States Party to the treaties may be involved with the launch, authorization, or supervision. After 30 years of practice, compliance with the *Registration Convention* has declined.[68] Furthermore, the lack of a requirement to update the orbital parameters or the

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[59] *Registration Convention*, *supra* note 11.
[60] See *supra* note 26 (*Outer Space Treaty* in 1967, *Rescue Agreement* in 1968, and *Liability Convention* in 1972).
[61] *Registration Convention*, *supra* note 11 at Article II(1).
[62] *Ibid.* at Article II(2).
[63] *Ibid.* at Article IV(1).
[64] *Ibid.* at Article II(1).
[65] *Ibid.* at Article I(a).
[66] *Outer Space Treaty*, *supra* note 5 at Article VII.
[67] *Liability Convention*, *supra* note 5 at Article I(c).
[68] Marietta Benko et al., *Space Law: Current Problems and Perspectives for Future Regulation* (Utrecht, Netherlands: Eleven International Publishing, 2005).

status of the spacecraft makes[69] the fundamental purposes of the Convention to locate and identify space objects difficult to accomplish with the provisions of this document or the existing state practice.[70] In the most congested orbit, the ITU assigns and identifies spacecraft with respect to the GEO independent of United Nations' registry. This is required to avoid interference with the use of radio frequencies. And, the USAF provides SSA data to government and commercial operators in a separate program to assist with collision avoidance. These supplemental efforts to regulate and coordinate space activity are stop gap measures to protect the tremendous investment placed in the space environment.

D. APPLICATION OF THE CONCEPT OF THE LAUNCHING STATE

> *… States conducting space activities, in fulfilling their international obligations under the United Nations treaties on outer space, in particular the* [Outer Space Treaty]*… consider enacting and implementing national laws authorizing and providing for continuing supervision of the activities in outer space of non-governmental entities under their jurisdiction.*
>
> *-Resolution on the Application of the Concept of the* Launching State

The Resolution on the *Application of the Concept of the "Launching State"*[71] in 2005 creates no additional obligations, but it does encourage the space faring states to implement their international obligations with regard to national space activity. Specifically, it made four recommendations to the supervising states and their regulatory bodies. First, it recommends space faring states recognize their international obligations under the *Outer Space Treaty* by enacting implementation laws to authorize and provide for continuing supervision of activities in outer space by the non-governmental entities under its jurisdiction. Using the same language found in Resolution 1962 (XVIII) and the *Outer Space Treaty* suggests that this resolution neither adds to the existing obligation nor is more instructive on how the Party States are to implement it. What it does demonstrate is the continuing need for supervision and a lacunae state supervision

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[69] *Liability Convention*, *supra* note 5.
[70] Lubos Perek, "The 1976 Registration Convention" (Paper presented to the International Institute of Space Law Symposium, 23 March 1998) [41st Colloquium on the Law of Outer Space].
[71] *Application of the Concept of the "Launching State"*, GA Res. 59/115, UN GAOR, 59th Sess., UN Doc. A/RES/59/115 (2004).

regulation.[72] Second, it recommends that states enter international agreements contemplated in the *Liability Convention* to reduce the likelihood of disputes and to create certainty with respect to liability in complicated international enterprises,[73] thereby recognizing the international nature of space activities and emphasizing the need to attribute responsibility in a transparent manner. Third, it calls on states to disclose their practices regarding transfer of ownership of space objects while on orbit. To date, state practice varies and the official statements of the space faring states is useful evidence of the emerging customary international law.[74] Fourth, it calls on states to harmonize national space legislation with international law. The other State Parties to the space legal regime rely on each State to honor its international obligations. A systemic failure to implement the agreed legal regime over time indicates a general lack of compliance which jeopardizes the negotiated principle of state responsibility through the differing state practice.[75]

E. INTERNATIONAL TELECOMMUNICATION UNION

> *In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.*
>
> -*Constitution of the ITU*, Article 44(2)

The singular international body to provide substantive and obligatory international standards for national space activity is the International Telecommunication Union (ITU).[76] ITU's role is to maintain and extend international cooperation between its 190 Member States for the improvement and rational use of telecommunications of all

[72] *Outer Space Treaty*, *supra* note 5 at Article VI.
[73] *Liability Convention*, *supra* note 5 at Article V(2).
[74] *Supra* note 17 at 6.
[75] *Supra* note 1 at 605.
[76] International Telecommunication Union, online: International Telecommunication Union <http://www.itu.org> (ITU is a Specialized Agency of the United Nations, located in Geneva, Switzerland).

kinds.[77] Originally founded to coordinate telegraph and telephone transmission protocols,[78] ITU expanded its mandate to create radio emission standards shortly after the radio age emerged.[79] As the space age began, ITU standards became central to coordinating transmissions to and from satellites with other uses of the limited radio frequency spectrum. Although originally concerned with terrestrial radio station transmissions, the advent of space station emission had the potential to disrupt the spectrum management globally.[80] Effective coordination of these earth orbiting stations require a global forum to avoid interference among the competing earth and space stations. As the demand for satellite operations increased, ITU formally expanded its mandate to provide adequate satellite licensing and operation standards to include the orbital positions on the GEO as well as uplink and downlink transmissions.[81]

Now constituting the largest international forum addressing space activity by involving the Member States,[82] intergovernmental organizations,[83] and other non-governmental entities,[84] ITU formulates regional and global standards to be applied through the member's national administration.[85] By establishing global radio frequency standards in such a broad forum, ITU exceeds the participation level of the UNCOPUOS[86] and the CD[87] in the establishment of supervision standards. However, the ITU forum is used by the international community to address broader issues such as

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[77] S*upra* note 51 at Article 1(1).
[78] Lawrence D. Roberts "A Lost Connection: Geostationary Satellite Networks and the International Telecommunication Union" (2000) 15 Berkeley Tech. L.J. 1095 at 1105 – 1106 (ITU can trace its official existence back to 1865 to coordinate the various domestic telegraphic systems through international agreements to standardize the telegraph systems and codes. Later telephone standards were integrated into the ITU.).
[79] *Ibid*. at 1107 (the Radio-telegraph Union formed to administer radio services through restrictions on the use of frequencies and power output of transmitters to minimize interference, but merged with ITU in 1932).
[80] Matthew Brzezinski, *Red Moon Rising: Sputnik and the Hidden Rivalries that Ignited the Space Age* (New York: Henry Holt and Company, LLC., 2007) (Sputnik signal was not transmitted on the agreed IGY assignment and multiple reports were made of interference occurring while passing overhead); John C. Cooper, "The Russian Satellite-Legal and Political Problems" (1957) 24 J. Air L. and Com. 379.
[81] *Supra* note 51 at Article 44.
[82] *Supra* note 76 (191 Member States).
[83] *Ibid*. (5 Intergovernmental Organizations).
[84] *Ibid*. (713 non-governmental entities with 567 Sector Members and 146 Associate Members).
[85] National administration for the United States is the Federal Communications Commission, other states refer their administrations generically as Post Telegraph and Telephone administration or PTT.
[86] United Nations Office for Outer Space Affairs, online: Office for Outer Space Affairs <http://www.unoosa.org/oosa/COPUOS/copuos.html> (69 Member States).
[87] United Nations Office at Geneva, online: Geneva Office <http://www.unog.ch> (65 Member States).

making communications more widely available, increasing security of transmissions in the interests of cyber security, and developing life saving communications for widely impacting events such as natural disasters.[88] Therefore, the space supervision interest competes with the many non-space priorities within this forum as its mandate is much broader than space supervision.

The standards created by ITU are expressed through its *Administrative Regulations,*[89] which includes the technical standards as presented in the *Radio Regulations.*[90] Member States are obligated to conform their use and supervision of the radio frequency spectrum to these regulations. As these regulations require frequent modifications to stay abreast of the technical changes, ITU employs an innovative provision which permits ratification of the convention to entail acceptance of the regulations existing at the time of the convention. Thereby, Member States remain current with the large and technical regulatory regime with limited reservation provisions to promote uniformity through a single act of ratification.[91] This generates a near universal set of standards for near space activity relating to the use of the radio frequency spectrum and the physical location of GEO assignments.

All frequency assignments are made by the Member State's national administration with coordination through the Radiocommunication Bureau at ITU.[92] And, Member States are to require its private entities to use radio frequencies in accordance with the *Radio Regulations.*[93] But to obtain an internationally enforceable assignment, ITU established three steps to effectively coordinate the global use of the limited frequency spectrum. All Member States are obligated to follow the *Radio Regulations* when making assignments.[94] Prior to making an assignment capable of harming the service of another administration,[95] for use in international communication,[96] and under other circumstances,[97] it is to follow the prescribed coordination procedures.

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[88] Secretary General Hamadoun I. Touré, (Address to the International Telecommunication Union in Cairo, Egypt, 11 May 2008).
[89] *Supra* note 51 at Article 4(3) (constitutes *International Telecommunications Regulations* and *Radio Regulations)*.
[90] *International Telecommunication Union Radio Regulations* [*Radio Regulations*].
[91] *Ibid.* at Article 54.
[92] *Ibid.* at Preamble.
[93] *Ibid.* at Article 45(1).
[94] *Ibid.* at Article 4.2.
[95] *Ibid*. at Article 11.3.

First, ITU provides the forum for coordinating the use of the radio frequency spectrum through allocation. The spectrum is allocated by the frequency band, the geographic location, and the type of service best suited to the characteristics of the band and the physical environment associated with the region. The result of these negotiations is the Table of Frequency Allocations. The next step is the allotment of frequency band segments to the requesting state. This may occur in one of two ways. Allotment most commonly occurs on the *first come, first served* basis.[98] This process is initiated by the national administration of the requesting state on behalf of the ultimate user and coordinated through the Bureau. The Bureau administers the coordination, notification and registration processes to ensure no prior authorized use will be adversely affected by the proposed assignment. This process allows all interested parties to comment and de-conflict the proposed operation. This process may be lengthy depending on the extent it affects other uses.[99] Allotment may also occur on an *a priori* basis for the limited frequency band in which the allocation process has already occurred at the world level and is incorporated into the *Radio Regulations*.[100] The requesting state applies to the Bureau for a simplified coordination procedure with other states as the band width is already reserved for its use.

Under either allocation process, successful coordination results in the application's entry on the Master International Frequency Register.[101] The final step is the assignment by the national administration for use by an individual or entity within its jurisdiction under a license. Assignments are the sovereign right of the Member State, but membership in ITU requires such authorization and continuing supervision by the national administration in accordance with the *Radio Regulations* and the Master Register.[102] The result for the administration and operator is an internationally recognized right to use the assigned frequency and a forum to address interference with its use.

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[96] *Ibid*. at Article 11.4.
[97] See generally *ibid*. at Article 11.
[98] *Ibid.* at Article 11.6.
[99] *Ibid.* at Article 9.
[100] *Ibid.* at Article 11.5.
[101] Ibid. at Article 8.
[102] *Ibid.* at Article 18.

The *Radio Regulations* creates additional standards to be implemented by the national administration. In return for assurances of no interference by other Member States, the national administration is likewise required to respect the Table of Frequency Allocations, Master Register, and the *Radio Regulations* when assigning frequencies to its domestic stations.[103] It requires the administration to limit the number of frequencies and the spectrum used to the minimum essential to provide satisfactory services and to employ the latest technical advances when issuing a license.[104] It is also required to minimize the assigned bandwidth and emission strength to avoid causing harmful interference to other radio stations.[105] This is required to maximize the beneficial use of this limited international resource by extending the available bandwidth and the associated orbital positions through responsible measures.

Although ITU regulates the use of the spectrum for all applications, some provisions apply specifically to space stations, or satellite operations. First, commercial satellite operations must be licensed by a national administration prior to operation.[106] They must be capable of cessation of emissions when required by the supervising administration in order to protect a superior interest. The *Radio Regulations* also distinguishes activity in the geostationary orbit from non-geostationary orbits. This is due to the special relationship the orbital slots in the GEO have with the given region on the earth within its footprint. On the other hand, satellites on all other orbital planes pass over the surface of the earth during its orbital period and do not occupy a specific slot over a given region.[107] Therefore, special considerations are given to the Member States based upon their relationship to the GEO. Traditionally, supervision was conducted through the licensing of transmissions to and from the satellite station to a fixed ground station. Such fixed satellite services (FSS) required a separate uplink and downlink frequency to operate. Technological advances in antennas now permit broadcast satellite services (BSS) to transmit from the satellite station to any receiver within its coverage area. This advance requires the supervising state to ensure all technical means to reduce

[103] *Ibid*. at Article 8.
[104] *Ibid*. at Article 4.1.
[105] *Ibid*. at Article 15.
[106] *Ibid.* at Article 18.
[107] *Supra* note 78 (Assuming a spacing of one satellite at approximately one-tenth of a degree separation, the GEO has a total capacity of 1,800 slots. However, only a subset of these slots is suitable for communications).

radiation over foreign territory unless a prior agreement is reached by the underlying state. This expands the administration's obligation to supervise its commercial sector by supervising its activity with regard to foreign states.[108]

The essence of the ITU regime is to maximize the utility of the frequency spectrum and to avoid harmful interference during its use as a coordination body for the supervising states. This is accomplished by recognizing the priority of use as established in the Master Registry and the coordination procedures to integrate new users efficiently into the spectrum. ITU is instrumental to both the authorization phase prior to commencing a space activity and to the supervision phase in order to ensure the activity conforms to the *Radio Regulations* out of necessity to coordinate the international use of the radio frequency spectrum.

F. INTER-AGENCY DEBRIS COORDINATION COMMITTEE

> *Member States and international organizations should voluntarily take measures, through national mechanisms or through their own applicable mechanisms, to ensure that these guidelines are implemented, to the greatest extent feasible, through space debris mitigation practices and procedures.*
>
> *- IADC Space Debris Mitigation Guidelines*

Finally, an *Inter-Agency Debris Coordination Committee (IADC)*[109] formed an intergovernmental body composed of space faring nations to address the growing hazards of manmade and natural debris in space. Orbital debris, or *space junk*, consists of artificial objects orbiting the Earth that are not functional spacecraft. Debris is a common hazard shared by all space faring nations whose individual mitigation measures were deemed insufficient to the task. To better address this collective hazard, space agencies[110] exchanged their mitigation standards and handbooks to create common guidelines with the goal of preventing on-orbit break-ups, removing spacecraft from

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[108] *Supra* note 90 at Article 23.
[109] Inter-Agency Space Debris Coordination Committee, online: IADC < http://www.iadc-online.org>.
[110] Italian Space Agency (ASI), British National Space Centre (BNSC), Centre National d'Etudes Spatiales (CNES), China National Space Administration (CNSA), Deutsches Zentrum fuer Luft-und Raumfahrt e.V. (DLR), European Space Agency (ESA), Indian Space Research Organisation (ISRO), Japan, National Aeronautics and Space Administration (NASA), the National Space Agency of Ukraine (NSAU) and Russian Aviation and Space Agency (Rosaviakosmos).

densely populated orbital regions at the end of their missions, and limiting the debris released during normal operations. The *IADC Guidelines*[111] recognized that expensive debris mitigation provides negligible benefits to the operator, but would have an immediate and adverse impact of the financial feasibility of the planned space activity. Therefore, the guidelines are voluntary and the scope of the recommendations is limited to cost effective measures to mitigate debris when planning and designing space activities to improve compliance.

The *IADC Guidelines* define space debris as all manmade objects including fragments and elements thereof, in near earth orbit and non-functional spacecraft. Mitigation measures include limiting the debris released during normal operations by minimizing the number, area, and orbital lifetime of the debris, as well as preventing explosions and ruptures at the end of missions and not initiating intentional destructions which will generate long lived orbital debris. Remedies include post mission disposal in GEO by boosting the satellite into a graveyard orbit outside this useful region, designing propulsion systems which do not separate from the spacecraft, or taking other measures to avoid their long term presence in this region. Finally, prevention of on-orbit collisions is enhanced by estimating and limiting the probability of accidental collision with known objects during the system's orbital lifetime.

The *IADC Guidelines* are not binding on the supervising state, but the collective wisdom of the IADC Member States and international organizations voluntarily implement these standards through their authorization and supervision regimes. These reflect the general consensus of minimal standards by responsible space faring states as reflected by existing practices, standards, codes, and handbooks developed by national and international organizations. And, the international body UNCOPUOS acknowledges the benefit of the *IADC Guidelines*.[112]

[111] *IADC Guidelines*, *supra* note 17.
[112] *Report of the Committee on the Peaceful Uses of Outer Space*, UNCOPUOS, 62nd Sess., Supp. No. 20, UN Doc. A/62/20 (2007).

G. EXPORT CONTROLS

> *These Guidelines, including the attached Annex, form the basis for controlling transfers to any destination beyond the Government's jurisdiction or control of all delivery systems (other than manned aircraft) capable of delivering weapons of mass destruction, and of equipment and technology relevant to missiles whose performance in terms of payload and range exceeds stated parameters. Restraint will be exercised in the consideration of all transfers of items within the Annex and all such transfers will be considered on a case-by-case basis. The Government will implement the Guidelines in accordance with national legislation … .*
>
> -*MTCR Guidelines*, Paragraph 1

Export controls have addressed space activities since the inception of the space age. Born contemporaneous to the atomic bomb, space and security are inextricably intertwined. The supervision requirement was created to assure State Parties that all national activities will be conducted in the spirit of the *Outer Space Treaty*. Export controls are a natural extension of this philosophy as responsible space faring governments provide assurances that their national space capabilities will not be extended to irresponsible ones.

The international community recognizes the need to exercise arms control over certain weapons and dual-use technologies. However, since the end of the cold war, the community has failed to reach a consensus to make a binding list of regulated items or the procedures by which to enforce such restraints. Therefore, arrangements are substituted by the partner states who share a common interest to limit a particular class of weapons or technology. The Achilles heel to these security arrangements is that implementation and enforcement is left to the member states' discretion. Below is a brief review of the arrangements which directly affect national space activity.

The *Missile Technology Control Regime (MTCR)*[113] established in 1987 specifically addresses missiles, their subcomponents, and related technology to advance the goal of non-proliferation of unmanned delivery systems capable of delivering weapons of mass destruction. This is accomplished through an informal and voluntary body to coordinate national export licensing efforts aimed at preventing their

[113] Missile Technology Control Regime, online: Missile Technology Control Regime <http://www.mtcr.info> (34 State Members).

proliferation. This export control arrangement is the most stringently applied regime on space transportation systems and payload integration.

The *MTCR* documents include the *MTCR Guidelines*[114] and the *Equipment, Software and Technology Annex*.[115] The *Guidelines* describe the purpose, organizational structure, and rules to guide the partner states and those who unilaterally apply *MTCR*. It recognizes that *MTCR* Partners must exercise particular care with sub-orbital launch vehicle equipment and technology transfers as this technology is virtually identical to that used in a ballistic missile. However, the *Guidelines* condition its application on the basis they are not meant to impede national space programs or international cooperation in such programs as long as such programs could not contribute to delivery systems for weapons of mass destruction.[116]

The *Annex* lists the items subject to *MTCR* controls and is updated every two years. The most recent *Annex* was adopted by the partner states in March 2007. The *Annex* is divided into Category I and Category II items. It includes a broad range of equipment and technology for both military applications and dual-use that are relevant to missile development, production, and operation. Partner states are to exercise restraint in the consideration of all transfers of items contained in the *Annex* and are to make their decisions on a case by case basis.[117]

Greatest restraint is reserved for Category I items. These items include complete rocket systems (including ballistic missiles, space launch vehicles, and sounding rockets) and unmanned air vehicle systems (including cruise missiles systems and target and reconnaissance drones) with capabilities exceeding the 300 kilometers range and 500 kilogram payload threshold. It also includes the production technology or major sub-systems including rocket stages, re-entry vehicles, rocket engines, guidance systems, and warhead mechanisms. The remainder of the *Annex* is regarded as Category II, which includes systems not covered in Category I capable of a maximum range equal to or greater than 300 kilometers. Also included are a wide range of equipment, material, and

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[114] *MTCR Guidelines*, online: Missile Technology Control Regime <http://www.mtcr.info/english/guidelines.html [*MTCR Guidelines*].
[115] *MTCR Equipment, Software and Technology Annex*, online: Missile Technology Control Regime <http://www.mtcr.info/english/annex.html [*MTCR Annex*].
[116] *Supra* note 114.
[117] *Ibid.*

technologies, most of which have uses other than for missiles capable of delivering weapons of mass destruction (WMD). While still agreeing to exercise restraint, partners have greater flexibility in the treatment of Category II transfer applications.[118]

The *Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies*[119] was formed in 1996 to address conventional arms, but unlike its predecessor, the *Coordinating Committee for Multilateral Export Controls (COCOM)*, it is not directed at any specific state. Rather, its purpose is to isolate destabilizing rogue states by denying them eight categories of weapon systems.[120] Category 7 includes rockets, ballistic or cruise missiles capable of delivering a warhead or weapon of destruction to a range of at least 25 kilometers, and the means to design or modified systems for such purpose.[121] The more recent *Nuclear Suppliers Group*[122] and *Zangger Committee*[123] address WMD on a cooperative basis to limit the transfer of such materials and the technology related to their delivery in weapon form. The *Australia Group*[124] was established in 1984 to prevent the proliferation of chemical and biological weapons as banned by the Chemical Weapons Convention of 1993 through export controls. As these arrangements are implemented by the individual states, the degree of compliance and care varies by state.[125] For the supervising state, the interest of security is systemic in its national space activity.

In conclusion, Article VI of the *Outer Space Treaty* establishes the principle of supervision for commercial space activity. The Treaty does not provide specific guidelines or minimum standards for adequate state supervision. However, the subsequent body of binding and non-binding international agreements regulating the conduct of space operations is created in furtherance of this principle. To re-open the

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[118] *Supra* note 115.
[119] Wassenaar Arrangement on Export Controls for Conventional Arms and Dual Use Goods and Technologies, online: Wassenaar Arrangement < http://www.wassenaar.org/> (65 State Members).
[120] *Guidelines & Procedures, including the Initial Elements (1996 as amended in 2003, 2004 and 2007),* online: Wassenaar Arrangement < http://www.wassenaar.org/guidelines/index.html>.
[121] *Lists of Dual Use Goods and Technologies And Munitions List (2007),* online: Wassenaar Arrangement <http://www.wassenaar.org/controllists/index.html>.
[122] Nuclear Suppliers Group, online: Nuclear Suppliers Group < http://www.nuclearsuppliersgroup.org/> (45 State Members).
[123] Zangger Committee, online: Zangger Committee < http://www.zanggercommittee.org> (36 State Members).
[124] The Australia Group, online: Australia Group < http://www.australiagroup.net> (40 State Members).
[125] Department of Commerce, online: <http://www.bis.doc.gov/policiesandregulations/multilateralexportregimes.htm>.

Treaty to promulgate such standards is not appropriate in such a universal Treaty.[126] The better method is to enter a separate agreement[127] to provide state administrations a set of general supervision principles by which to conduct supervision and a mechanism to create minimal standards based upon technical feasibility and commercial practices of the time.

In conclusion, the lacuna in supervision standards is central to the risks upon which a consensus may be formed to improve the prospects for using space for the betterment of mankind. The alternative is to continue the practice of relying upon international bodies with mandates other than to advance the use of space to create de facto supervision standards based upon the limited and possibly counterproductive needs of the disciplines which overlap with space applications. And in the development of space supervision agreement, perhaps the international community may come closer to addressing the more rancorous issues of militarization and serving the interests of the less developed nations. The next chapter will review the United States implementation of a supervisory regime.

[126] *Outer Space Treaty*, s*upra* note 5 at Article XV.
[127] See e.g. *Liability Convention*, *Rescue Agreement* and *Registration Convention*.

III. CONTINUING SUPERVISION BY THE UNITED STATES

> *It is in the interest of the United States to foster the use of [United States] commercial space capabilities around the globe and to enable a dynamic, domestic commercial space sector. To this end, departments and agencies shall …* [*m*]*aintain a timely and responsive regulatory environment for licensing commercial space activities… .*
>
> -United States National Space Policy

This chapter examines the major supervisory functions performed by the United States government. In such a review, it must be acknowledged that many factors make regulating commercial space activities a complex regime. Beyond the explicit international obligations and commitments by the United States toward other nations, it also has internal interests to implement through a continuing supervision regulatory regime. The concept of national self interest can be divided into three separate, but mutually supporting, categories. They are internal security,[1] external defense,[2] and economic[3] development.[4] This list is not exhaustive and the relative weight given each interest changes over time.[5] However, these categories represent the national interest paradigm for which the United States' government is structured to address. A second set of dynamics comprises the organizational priorities within each bureaucracy. The politically appointed head of the agency has a political agenda to implement each election

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[1] Department of Homeland Security (DHS) is responsible for internal security by unifying the national network of organizations and institutions into one department, but Congress has delayed the opening of the National Applications Office intended to coordinate the use of satellites for activities such as border security, natural disasters, and support to state and local law enforcement. The existing Civil Applications Committee (CAC) is an interagency committee that coordinates and oversees the civil use of government space applications.

[2] Department of Defense (DOD) is responsible for national security with the National Security Space Office (NSSO) acting as the focal point for the integration and coordination of defense, intelligence, civil, and commercial space activities; Department of State (DOS) is responsible for international relations with Directorate of Defense Trade Controls (DDTC) administers the International Traffic in Arms Regulations (ITAR) to control the export of defense items on the United States Munitions List (USML) to prevent the proliferation of sensitive weapons and defense technology through commerce.

[3] Department of Commerce (DOC) is responsible for economic development with the National Oceanic and Atmospheric Administration (NOAA) as the principal unit for space commerce policy activities to foster economic growth and technological advancement of the commercial space industry.

[4] The White House, *U.S. National Space Policy* (2006) [Unclassified].

[5] Department of Transportation (DOT) is responsible for enhancing the economy and defense through transportation development, the Office of Commercial Space Transportation (AST) promotes the commercial development of launch, re-entry, and space port services; National Aeronautics and Space Administration (NASA) stimulates commercial enterprises in space to support specific missions and to encourage development of the commercial space sector. It indirectly supports defense by disclosing discoveries it would find beneficial.

cycle in response to the electorate.[6] Likewise, the non-appointed professional executive service has a longer term agenda to preserve and develop the personnel and programs within the organization. Finally, the level at which implementation is discharged ranges from strategic political decisions undertaken by the Congress,[7] President,[8] or agency head[9] to the technical and procedural decisions entrusted to civil servants, and increasingly delegated outside the government to contractors.[10] The prevailing balance of the interests since the 1980s has favored economic stimulation of the commercial space sector while maintaining the status quo in civil and military space capability through privatization.[11]

The resulting national regulatory regime is shaped by many competing interests outside the continuing supervision obligation. The interests advanced are broader than the three trends discussed here or the international obligations untaken by the United States. The resulting supervision regime also has considerable influence on other states. This regime establishes the technology means available for space activity.[12] The resulting national position delivered to international bodies influences the final form of the agreement or arrangements,[13] and shapes international customary law over the long term by providing evidence[14] of state practice[15] with regard to commercial space activity.

Authorization only addresses the commencement of the commercial activity at which point noncompliance is easily addressed on the ground. Continuing supervision continues over the life of the commercial space activity. As a consequence, this regime addresses the classic legal quandary of how to motivate behavior which is beneficial to society at large and what coercion is adequate to prevent harmful or destructive activity

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[6] See e.g. United States Congress, *Commission to Assess United States National Security Space Management and Organization* (2001) [*Rumsfeld Report*].
[7] See generally *United States Code*
[8] See especially The White House, *U.S. Space Transportation Policy* (2005).
[9] See generally *Code of Federal Regulations*; See e.g. National Aeronautics and Space Administration, *2006 NASA Strategic Plan* (2006).
[10] *Commercial Space Transportation,* 14 C.F.R. §§ 400.1 et seq.
[11] S*upra* note 4; *Supra* note 8.
[12] *International Telecommunication Union Radio Regulations* at Article 23 [*Radio Regulations*].
[13] See e.g. Inter-Agency Debris Coordination Committee, *IADC Space Debris Mitigation Guidelines* (2007), online: Inter-Agency Space Debris Coordination Committee <http://www.iadconline.org/> [*IADC Guidelines*] (implemented by AST).
[14] Ian Brownlie, *Principles of Public International Law* (Oxford and New York: Oxford University Press, 2003) at 6-12.
[15] *Statute of the International Court of Justice,* 26 June 1945, 59 Stat 1031, 3 Bevans 1179 [*ICJ*] at Article 38.

in space.[16] Unlike government activity, commercial space is directed by investors whose values and objectives are not the same as the supervising government.[17] Supervision must address the lifetime of the activity, station keeping, re-mission, the move to graveyard orbit, and remediation issues. Digressing from the aviation analogy, spacecraft may never return to earth and the expense of physically obtaining possession of the spacecraft will almost never be warranted. Therefore, it is important for the United States to possess a comprehensive regulatory regime administered effectively over commercial space activity.

For the United States, the major departments and agencies conducting supervision are the Department of Transportation (DOT), Federal Aviation Administration (FAA), Federal Communications Commission (FCC), Department of Commerce (DOC), Department of State (DOS), Department of Defense (DOD), and, the National Aeronautics and Space Administration (NASA). No one department or agency has exclusion or even priority over such supervision for the United States.

State implementation of the continuing supervision obligation varies greatly by the amount of expressed regulatory guidance,[18] capability to monitor activities,[19] and capacity to compel compliance.[20] The example of implementation by the United States is particularly useful because it is expressed so thoroughly in its laws and regulations. Furthermore, it possesses an unsurpassed capability to observe commercial activity as a result of its Cold War era surveillance systems which were intended to detect space born threats. The regulatory authorities exercise power over the commercial space sector through a complex structure of administrative, civil, and criminal law forums in order to obtain compliance. Therefore, the United States' implementation of the general principle

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[16] David Barboza "Technology Briefing: Telecommunications Iridium Satellite Wins Pentagon Contract" *New York Times* (8 December 2000). (Commercial space providers carry large business risk).
[17] United States House of Representatives, *U.S. National Security and Military/Commercial Concerns with the People's Republic of China* (1999) online: House of Representatives <www.house.gov/coxreport/> [*Cox Report*].
[18] *Review of existing national space legislation illustrating how States are implementing, as appropriate, their responsibilities to authorize and provide continuing supervision of non-governmental entities in outer space*, UNCOPUOS, 40th Sess., UN Doc. A/AC105/C.2/L.224 (2001).
[19] Darling, David, *The Complete Book of Spaceflight, From Apollo 1 to Zero Gravity* (Hoboken, New Jersey: John Wiley & Sons, Inc., 2003).
[20] See e.g. Baikonur Cosmodrome, Kazakhstan leased by the Russian Federal Space Agency until a replacement site is developed at Plesetsk, Russia; Kourou Space Center, French Guiana located in South America as an overseas region of France under the rule of a Prefect.

of state responsibility through the exercise of supervision over non-governmental entities is an excellent test case for this international obligation as the State Party to the *Outer Space Treaty* with the most comprehensive regulatory and compliance mechanisms.

A. DEPARTMENT OF TRANSPORTATION

> [*T*]*he Secretary of Transportation is to oversee and coordinate the conduct of commercial launch and reentry operations, issue permits and commercial licenses and transfer commercial licenses authorizing those operations, and protect health and safety, safety of property, and national security and foreign policy interests of the United States.*
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> -49 U.S.C. §70101(b)(3)

The purpose of the Department of Transportation (DOT) is to ensure fast, safe, efficient, accessible and convenient transportation systems that meet the vital national interests and enhance the quality of life of the American people.[21] The DOT was established by Congress in 1966 and signed into law by President Lyndon B. Johnson, who was instrumental in the development of the civilian space program. As a cabinet level executive department, the Secretary of Transportation is responsible for the development and coordination of policies for the national transportation system and is to give due regard for the transportation need, environment, and the national defense.[22]

DOT consists of the Office of the Secretary and eleven individual Operating Administrations: Federal Aviation Administration, Federal Highway Administration, Federal Motor Carrier Safety Administration, Federal Railroad Administration, National Highway Traffic Safety Administration, Federal Transit Administration, Maritime Administration, Saint Lawrence Seaway Development Corporation, Research and Innovative Technologies Administration, Pipeline and Hazardous Materials Safety Administration, and Surface Transportation Board. In 2002, the Department of Homeland Security (DHS) assumed management of both the Coast Guard and the Transportation Security Administration.[23]

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[21] Department of Transportation, online: Department of Transportation <http://www.dot.gov/mission.htm>.
[22] ___. online: Department of Transportation <http://dotlibrary.dot.gov/Historian/ history.htm>.
[23] *Supra* note 21.

Throughout the nation's history, transportation projects were subjected to poor long term planning and funding. The creation of a single department level overseer was to allow a more efficient national transportation policy by consolidating widely varying programs to address the larger transportation need. Facing a similar dilemma, Congress decided to place the Office of Commercial Space Transportation (AST) within the DOT upon enactment of the *Commercial Space Launch Act of 1984.* This new and yet to be defined mission to promote and to regulate commercial space launch vehicles was initially located in the Office of the Secretary because no operating administration had a comparable mission and because of its modest initial funding.[24]

B. FEDERAL AVIATION ADMINISTRATION

> *[T]he United States should encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States.*
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> -49 U.S.C. §70101(7)

In November 1995, the Office of Commercial Space Transportation was transferred to the Federal Aviation Administration (FAA) and designated the Office of the Associate Administrator for Commercial Space Transportation (AST, collectively abbreviated FAA/AST). Its purpose is to ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or reentry activity. AST also encourages, facilitates, and promotes United States commercial space transportation services.[25] The combination of regulating an inherently dangerous activity while also promoting its commercial success can be viewed as both complementary and contradictory. Presently AST has four licensed launches pending and no permitted launches.[26] With a relatively safe performance record and a declining share of the commercial launch market, the balance appears on the surface to be in favor of compliance with safety and security.

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[24] *Supra* note 22.
[25]Federal Aviation Administration, online: Federal Aviation Administration <http://www.faa.gov/about/ office_org/ headquarters_offices/ast/> (assessed 1 May 2008).
[26] *Ibid*.

AST is administered by the Office of the Associate Administrator. It is further divided into three divisions. First, the Space Systems Development Division provides space systems engineering, space policy, and economic and launch forecasts. It also consults with prospective launch and site license applicants, develops regulations for new technologies as they prepare to enter service, and integrates space launch activities into a Space and Air Traffic Management System (SATMS) as part of the FAA's national airspace modernization plan.[27] Second, the Licensing and Safety Division ensures public health and safety by licensing commercial launches and re-entries, licensing the operation of non-federal space launch sites, and determining minimum insurance requirements for commercial launch activities. Third, the Systems Engineering and Training Division creates safety standards for existing and proposed launch and re-entry systems and sites and verifies that standards are met by the licensee. It provides regulatory assistance and vehicle safety assessments to license applicants. It also issues Experimental Permits for Reusable Suborbital Rockets.[28] AST provides authorization through the approval of license applications. Finally, it provides continuing supervision by monitoring licensee compliance throughout the commercial activity.

AST's statutory authority is provided in the *Commercial Space Launch Act of 1984*, as amended.[29] Congress found that private space activities achieved a significant level of commercial activity and offered potential growth in telecommunications, information services, microgravity research, human space flight, and remote sensing. Therefore, it empowered AST to authorize launch services and reentry services in the private sector consistent with the national security and foreign policy interests of the United States through stable, minimal, and appropriate regulatory guidelines.[30] It found AST should encourage private sector launches, reentries, and associated services. And to the extent necessary, it should regulate commercial activity to ensure compliance with international obligations and protect the public health, safety, property, national security,

[27] Federal Aviation Administration, *Next Generation Air Transportation System*, online: Federal Aviation Administration <http://www.faa.gov/regulations_policies/reauthorization/>.
[28] Federal Aviation Administration, online: Office of Commercial Space Transportation <http://www.faa.gov/about/office_org/headquarters_offices/ast/about/>.
[29] *Commercial Space Launch Act of 1984*, 49 U.S.C. §§70101 et seq.
[30] *Ibid*. at § 70101(6).

and foreign policy interests of the United States.[31] Furthermore, the AST regulations[32] cite its authority under the Act, and the applicable treaties and international agreements to which the United States is party.[33] AST's mandate is limited to non-governmental space activity as the Act specifically excludes launch, reentry, operation of a launch vehicle or reentry vehicle, operation of a launch site or reentry site, or other space activity which the government carries out for itself.[34]

AST implements its supervision obligation through its licensing authority in this Chapter. It requires a license or experimental permit to be issued by AST before any person may operate a launch vehicle or site in the United States, or for a citizen to do so outside the United States.[35] A citizen is defined as an individual who is a citizen of the United States, an entity organized or existing under its domestic laws, or an entity organized or existing under the laws of a foreign country if the controlling interest is held by the individual or entity described above.[36]

The *Commercial Space Launch Amendments Act of 2004* added provisions regarding the safety of human flight in expectation of suborbital flights in the near future. The payload[37] carried may only be launched if the holder of the license complies with all requirements of the laws of the United States related to launching or reentering the payload.[38] Toward this end, coordination between AST and the other departments is directed.[39] A licensee must allow AST to continuously monitor its activities for the duration of licensed activities, including placing an officer at the licensee's site.[40] AST may modify a license already issued or transferred to ensure conformity with AST regulations.[41] Operations such as launch and reentries may be halted at any time if found to be detrimental to public health, safety, or property or contrary to national security or

[31] *Ibid*. at § 70101(7).
[32] 14 C.F.R. Part 400 et seq.
[33] *Ibid*. at § 400.1.
[34] *Supra* note 29 at § 70117(g)(1).
[35] *Ibid*. at § 70104.
[36] *Ibid*. at § 70102(1)(A-C).
[37] *Supra* note 32 at §§ 415.51-415.63.
[38] *Supra* note 29 at § 70104(b).
[39] *Ibid*. at §§ 70116 and 70117.
[40] *Ibid*. at § 70106.
[41] *Ibid*. at § 70107.

foreign policy interest.[42] The effective period of such orders remains in effect until an administrative review is conducted by the DOT. An adverse administrative ruling is subject to judicial review as the final action by the Secretary.[43] Additionally, government launch activity may preempt commercial activities at government sites, but is to be avoided through close coordination with DOD and NASA when possible.[44]

AST implements the *Outer Space Treaty Article* VII and *Liability Convention* in part by requiring the commercial operator to indemnify the United States for the first $500 million for third party damages and $100 million for government property damages.[45] The participants are to enter a reciprocal waiver of claims with one another. In addition, the United States statutorily acknowledges its own liability up to $1.5 billion.[46] This last provision is inconsistent with both international obligations in that neither contains a cap on damages. However, the fiscal law peculiar to the United States does not permit unlimited obligations and this provision implements the general principle of state liability. Even if Congress acknowledged its unlimited liability, such expenditure would require a separate act to appropriate the sum to be paid by the Department of the Treasury.[47]

AST also implements the *Outer Space Treaty* Article VIII and *Registration Convention*[48] obligations to ensure openness and transparency by registering space objects. Prior to launch, the operator must provide notification to AST, DOD and FCC through a Launch Notification Form providing the launch site and date, launch vehicle and payload description, and orbital parameters.[49] Post launch, but not later than 30 days after the launch, the operator must provide to AST the following information for each object placed in space by a licensed launch, including a launch vehicle and any of these

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[42] *Ibid*. at § 70108.
[43] *Ibid*. at § 70110.
[44] *Ibid*. at § 70109.
[45] *Ibid*. at § 70112.
[46] *Ibid*. at § 70113.
[47] 31 U.S.C. 1301(d) ("A law may be construed to make an appropriation out of the Treasury or to authorize making a contract for the payment of money in excess of an appropriation only if the law specifically states that an appropriation is made or that such a contract may be made"); *U.S. v. MacCollom*, 426 U.S. 317 at 321 (1976) ("The established rule is that the expenditure of public funds is proper only when authorized by Congress, not that public funds may be expended unless prohibited by Congress").
[48] *Convention on the Registration of Objects Launched into Outer Space*, 12 November 1974, 1023 U.N.T.S. 15, 28 U.S.T. 695 [*Registration Convention*].
[49] *Supra* note 32 at § 415 Appendix A (Launch Notification Plan).

components: the international designator of the space object, date and location of launch, general function of the space object, and final orbital parameters.[50]

Debris mitigation is regulated by AST by requiring a debris analysis for an orbital or suborbital launch to identify the inert, explosive, and other hazardous launch vehicle debris that result from normal and malfunctioning launch vehicle flight. In case of launch vehicle breakup, a debris analysis must account for each cause of launch vehicle breakup and debris fragment lists for each cause of breakup and any planned jettison of debris, launch vehicle components, or payload. The lists must account for all launch vehicle debris fragments, individually or in groupings of fragments whose characteristics are similar enough to be described by a single set of characteristics. The debris lists must describe the physical, aerodynamic, and harmful characteristics of each debris fragment.[51]

Space Traffic Management provisions are implemented to a limited extent by AST. It requires a collision avoidance analysis to establish a launch wait in order to protect any manned orbiting objects. A launch operator must account for uncertainties associated with launch vehicle performance and timing and ensure that any calculated launch waits incorporate all additional time periods associated with such uncertainties. For an orbital or suborbital launch, the analysis must establish any launch waits needed to ensure that the launch vehicle, any jettisoned components, and its payload do not pass closer than 200 kilometers to a manned orbiting object during ascent to initial orbital insertion through at least one complete orbit.[52]

The FAA's traditional air traffic management system has coordinated government and commercial space launches from government ranges for several decades. As the ranges are primarily located along the coasts and launches are infrequent, its impact on the national airspace has not caused severe constraints on national airspace management. However, the FAA recognizes the difficulties of managing an increasing aviation traffic load as governmental and non-governmental space activities increase in frequency and locations. Especially activity originating from interior domestic spaceports will require a new approach to its traditional air traffic management system. AST began a strategic

[50] *Ibid*. at § 417.19.
[51] See generally *ibid*. at § 417; See especially §§ 211, 225 and 417.107.
[52] *Ibid*. at § 417.231.

initiative in 2001 to develop a concept of operations for an integrated SATMS as initially set out in the *Concept of Operations for Commercial Space Transportation in the National Airspace System Narrative*[53] and its *2005 Addendum*[54] (collectively referred to as CONOPS). SATMS represents a conceptual aerospace environment in which space and aviation operations are seamless and fully integrated in a modernized national airspace system to meet the increased demands on space and air traffic management. This will require a new approach to airspace management by introducing new technology and management practices. It is important to note that these documents support the larger Next Generation Air Transportation System (NextGen) infrastructure re-design by the FAA[55] and the Communications, Navigation, and Surveillance Systems for Air Traffic Management (CNS/ATM) by ICAO.[56] As the FAA modernizes its infrastructure and procedures, AST provides its input to ensure the commercial space activity it predicts to be possible over the next 20 years can be accommodated without interrupting the transportation needs of space or aviation.

The CONOPS is intended to serve as the cornerstone upon which to build an efficient air traffic management system with commercial space transportation as an integral component. SATMS thereby limits its scope to space launch activity within a national airspace management context. To manage space activity as it transitions through the national air space to and from space, the concept for future space transportation operations relies on a domestic Space Operations Coordinator (SpOC) to manage the space activity within the domestic national airspace and who will be physically located at the aviation traffic management center.[57] The SpOC manages the integration of space missions into the national air space only, but recognizes the role of an International Space Flight Organization (ISFO) as an internationally sanctioned organization whose function would be to exchange information and collaborate on orbital and sub-orbital flights which

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[53] Federal Aviation Administration. *Concept of Operations for Commercial Space Transportation in the National Airspace System Narrative, Version 2.0* (2001).
[54] ___. *Concept of Operations for Commercial Space Transportation in the National Airspace System, Addendum 1: Operational Description* (2005).
[55] Federal Aviation Administration, online: Office of Commercial Space Transportation <http://www.faa.gov/news/facts_sheets/news_story.cfm?newsId_8145>.
[56] Vincent Galotti, "Global Air Traffic Management: ICAO's Efforts toward Implementation" (2008) 63 The ICAO Journal 2.
[57] *Supra* note 53 at 8.

transcend national traffic management. Such an organization is not in existence and is possibly contrary to the present *U.S. National Space Policy of 2006*. The SATMS utility in applying continuing supervision of non-governmental activity such as RLVs and suborbital flight operations which extend beyond the national airspace is not realized.[58] Presently, AST does not have authority or a realistic plan for managing commercial orbital space traffic. To the degree such coordination occurs within the government, USAF cooperates with commercial operators under the Commercial and Foreign Entities (CFE) pilot program.

The breadth of supervision continues to expand to address the new space applications. Recent regulatory developments include private human space flight regulations.[59] As multiple suborbital space travel vehicles and providers near operation, AST issued regulations in 2007 establishing crew and space flight participant (passenger) requirements. This action represents the first implementation of continuing supervision obligation with regard to commercial space travel. The United States now regulates crew and vehicle qualifications in a manner similar to aviation regulations as required to comply with the *Chicago Convention* and the ICAO Standards and Recommendations (SARP).[60] Experimental launch permit regulations are an accommodation to entrepreneurs to promote the commercial space industry by avoiding the more restrictive licensing process. Permits allow unlimited launches and reentries during a given period and reduce the burdens associated with the licensing process. However, permitted activity may not transport cargo or passengers and does not enjoy indemnification.[61]

In summary, AST implements the supervision obligation with respect to commercial space transportation systems operated by nationals and activities within its territory. The DOT does not extend its supervision to orbital activities. Other departments and agencies regulate some activity on orbit and at the ground segment. As for implementing national interests, DOT and AST coordinate with DOD, DOS and DOC to further national defense. Its internal security is supported through safety regulations and oversight. And, AST actively encourages economic development

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[58] *Ibid.* at c. 3.
[59] *Supra* note 29 at § 70101(a)(15); See generally s*upra* note 32.
[60] *Supra* note 32 at Part 431.
[61] *Supra* note 29 at § 70105a.; *Supra* note 32 at § 437.21 et seq.

through commercial space transportation. These interests are mutually supporting, as a strong commercial base makes possible the current policy to rely on commercial entities for defense space access.

C. FEDERAL COMMUNICATIONS COMMISSION

> [*The FCC has*] *authority to inspect all radio installations associated with stations required to be licensed by any Act, or … treaty, or convention binding on the United States … to ascertain whether in construction, installation, and operation they conform to the requirements of the rules and regulations of the* [*FCC*]*, the provisions of any Act, the terms of any treaty or convention binding on the United States and the conditions of the license or other instrument of authorization under which they are constructed, installed, or operated.*
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> - 47 U.S.C. §303(n)

The purpose of the Federal Communications Commission (FCC) is to regulate interstate and international communications by radio, television, wire, satellite, and cable. The FCC was established by the *Communications Act of 1934* as amended, as an independent agency directly responsible to Congress and directed by five Commissioners appointed by the President and confirmed by the Senate for 5 year terms. The President designates one Commissioner as Chairperson who serves as the chief executive officer of the Commission.[62]

The FCC consists of the Commission staff and seven operating Bureaus whose responsibilities include the following: processing applications for licenses and other filings, analyzing complaints, conducting investigations, overseeing regulatory programs, and administrative hearings. First is the International Bureau which represents the Commission in satellite and international matters.[63] This Bureau has three divisions. The Policy Division conducts international spectrum rulemakings, develops international telecommunications policy, licenses international telecommunications facilities (including submarine cables), and advises on foreign ownership questions. The Division's goals for international telecommunications policy are to achieve low calling

[62]Federal Communications Commission, online: Federal Communications Commission <http://www.fcc.gov/aboutus.html>.
[63] *Ibid*.

rates for domestic consumers and to facilitate competition in international services. In furtherance of these goals, the Division authorizes satellite systems as quickly as possible to facilitate deployment of satellite services, minimize regulation and maximize flexibility for satellite telecommunications providers to meet customer needs, and to foster efficient use of the radio frequency spectrum and orbital resources. The Division also promotes commercial satellite activities through domestic spectrum management and advocates for United States' satellite radiocommunication interests in international coordination and negotiation meetings. The Strategic Analysis & Negotiations Division oversees the Commission's participation at ITU conferences, including World Radiocommunication Conferences and regional organizations, such as the Asia-Pacific Economic Cooperation (APEC), the Inter-American Telecommunications Conference (CITEL), the Organization for Economic Cooperation and Development (OECD), and bilateral negotiations with Canada and Mexico on Region 2 issues. The Division analyzes international economic and regulatory trends to shape policy.[64]

The Consumer & Governmental Affairs Bureau informs consumers about telecommunications services and coordinates telecommunications policy efforts with industry and with the other governmental agencies. The Enforcement Bureau makes compulsory the *Communications Act* and Commission's rules, orders, and authorizations. The Media Bureau regulates AM, FM radio and television broadcast stations, cable television, and satellite services. The Wireless Telecommunications Bureau oversees cellular and PCS phones, pagers and two-way radios. This Bureau also regulates the use of radio spectrum to fulfill the communications needs of the telecommunications business, aircraft and ship operators, and individuals. The Public Safety & Homeland Security Bureau addresses public safety, homeland security, national security, emergency management and preparedness, disaster management, and other related issues. The Wireline Competition Bureau is responsible for regulations concerning telephone companies that provide interstate telecommunications services through wire transmission. Additionally, the Office of Administrative Law Judges presides over hearings, and issues Initial Decisions to decide disputes at the Bureau level.[65]

[64] *Ibid*. at <http://www.fcc.gov/ib/>.
[65] *Ibid*. at <http://www.fcc.gov/aboutus.html>.

Like the DOT, the FCC manages a myriad of communication functions within one government body. The FCC emphasizes economic development interests while recognizing the importance of the technical parameters required to maximize the use of telecommunications satellites. Congress authorizes and directs the FCC to promulgate a regulatory regime to implement the provisions of the Act, international radio or wire communications treaty or convention, or regulations annexed thereto, including any treaty or convention that relates to the use of radiocommunications, to which the United States is or may hereafter become a party.[66] The comprehensive regulatory regime fulfills the obligation of the national administration codified in the *ITU Constitution* and *Convention*, and *Administration Regulations*. Of the *Administrative Regulations*, the *Radio Regulations* express more specifically the procedures instrumental to continuing supervision by national administrations such as the FCC with respect to radio frequency and associated orbital positions.

The *Communications Act of 1934*[67] as amended provides for the regulation of interstate and foreign communication by wire or radio. This Act provides the backbone of the FCC legal regime and is supplemented and amended by other Acts. For example, the *Telecommunications Act of 1996*[68] promotes competition and reduces regulation to lower prices and raise the quality of service for American consumers and to encourage the rapid deployment of new telecommunications technologies. The *Communications Satellite Act of 1962*,[69] although largely revoked, was intended to establish and regulate a commercial communications satellite system. The *Communications Assistance for Law Enforcement Act*[70] supplements the *Communications Act of 1934* and amends the criminal code at Title 18 to make clear the telecommunications operator's duty to cooperate in the interception of communications for law enforcement purposes.[71] However, telecommunications carriers have a contra duty to protect the confidentiality of proprietary information of customers.[72]

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[66] 47 U.S.C. § 303(r).
[67] *Communications Act of 1934*, 47 U.S.C. §§ 151 et seq.
[68] *Telecommunications Act of 1996,* Pub. L. No. 104-104, 110 Stat. 56 (1996).
[69] *Communications Satellite Act* 47 U.S.C. §§ 731 et seq.
[70] *Communications Assistance for Law Enforcement Act,* 47 U.S.C. §§ 1001 et seq.
[71] *Supra* note 67 at § 229(a).
[72] *Ibid*. at § 222.

Collectively, these provisions are ultimately implemented through FCC regulations[73] to maintain control by the United States over all the channels of radio transmission under station licenses granted for limited periods of time. No person shall operate any apparatus for the transmission of energy, communications, or radio signals without an operator license. And, no license is to be construed to create any right beyond its terms, conditions, and period. Finally, interference caused by station transmissions are prohibited except when done in accordance with this Act and with a license granted under the provisions of this Act.[74] As an extra measure, a station license may be modified by the FCC for a limited time if in the judgment of the FCC such action will promote the public interest, convenience, and necessity, or the provisions of the Act or treaty ratified by the United States will be more fully complied with.[75]

The FCC implements the ITU Table of Frequency Allocations by regulating the nature of the service to be rendered by each station.[76] It implements the *Radio Regulations* in part by assigning bands of frequencies to classes of stations consistent with ITU allotment and assigns frequencies to each individual station in accordance with the Master International Frequency Register. Its domestic authority directs it to allocate the electromagnetic spectrum within its territory consistent with international agreements and the public interest. It also adds the duty to promote investment in communications services and systems, technology development, and to avoid harmful interference among users.[77] Consistent with the *Outer Space Treaty* principle of non-appropriation and the ITU consensus that licenses are not permanent, each FCC license, initial or renewal, to operate a broadcasting station shall be for a term not to exceed 8 years.[78] The practical result of this regulation is that subsequent licenses may be issued indefinitely just as licenses on the *Master Register* may likewise continue indefinitely after the initial satellite is placed in orbit.

Prior to receiving an operation license under the authority of the Act, the station must have been constructed pursuant to a permit also granted by the FCC. The

[73] 47 C.F.R. Chapter I.
[74] *Supra* note 67 at § 301.
[75] *Ibid*. at § 316(a)(1).
[76] *Ibid*. at § 303(a).
[77] *Ibid*. at § 303(y).
[78] *Ibid*. at § 307(c)(1).

application for a construction permit prescribes regulations as to the citizenship; character; financial, technical, and other ability of the applicant to construct and operate the station; the ownership and location of station; frequencies; hours; purpose for which the station is to be used; type of transmitting apparatus to be used; power to be used; date the station is expected to be completed and in operation; and such other information as the FCC may require.[79] Such a permit for construction is automatically forfeited if the station is not ready for operation within the time specified unless prevented by causes not under the control of the grantee.[80] The FCC regulates devices which in their operation cause interference with radio reception to include systems for use by the Government of the United States, taking into account the unique needs of national defense and security.

A station licensed by the FCC shall not be subject to action by a State or local government with respect to the station license, but is subject to other local regulation.[81] The actual operation of all transmitting apparatus in any radio station for which a station license is required by this Act shall be carried on only by a person holding an operator's license, and no person shall operate any such apparatus except under and in accordance with an operator's license issued by the FCC. Exceptions are made for stations for which licensed operators are required by international agreement and stations for which licensed operators are required for safety purposes.[82]

The FCC further implements the *Radio Regulations* by determining the power each station shall use and the time of operations.[83] In all circumstances, except in case of radio communications or signals relating to vessels in distress, radio stations are to use the minimum amount of power necessary to carry out the communication desired.[84] The FCC determines the location of stations,[85] the kind of apparatus affecting emissions,[86] and regulations to needed prevent interference between stations and to carry out the provisions of this Act.[87] It has authority to establish areas to be served by stations[88] and

[79] *Ibid*. at § 319(a).
[80] *Ibid*. at § 319(b).
[81] *Ibid*. at § 302a.
[82] *Ibid*. at § 318.
[83] *Ibid*. at § 303(c).
[84] *Ibid*. at § 324.
[85] *Ibid*. at § 303(d).
[86] *Ibid*. at § 303(e).
[87] *Ibid*. at § 303(f).
[88] *Ibid*. at § 303(i).

require stations to keep records of transmissions of energy, communications, or signals.[89] It has authority to suspend the license of any operator upon proof sufficient to satisfy the FCC that the licensee has violated, or caused, aided, or abetted the violation of any Act, treaty, or convention binding on the United States.[90] It is to ascertain whether the construction, installation, and operation of stations conform to the requirements of the Act, Treaty, or Convention. To ensure compliance with the same or to investigate allegations of violations, the FCC has authority to inspect stations requiring a license under this Act or which are subject to the provisions of a treaty or convention.[91]

Content controls are prevalent in both free and closed societies. The customary rule under international law for terrestrial broadcasts is the principle of freedom of broadcasting. On earth, every state has the right and ability to broadcast information by radio across national border without agreement or prior consent. Exceptions to this principle are to not incite armed revolt, revolution, war, or propaganda endangering internal security or order.[92] In 1948, the United Nations famously recognized the right of all people to seek, receive, and impart information and ideas.[93] Conversely, the receiving state may not take countermeasures which are not strictly limited to its own territory. The FCC provides that no station shall rebroadcast the program or any part thereof of another broadcasting station without the express authority of the originating station.[94] No person shall willfully or maliciously interfere with or cause interference to any radio communications of any station licensed or authorized by or under this Act or operated by the government.[95]

In space, however, this principle does not apply. Although the United States promotes free access and is against content control,[96] the majority of states do not concur

[89] *Ibid*. at § 303(j).
[90] *Ibid*. at § 303(m).
[91] *Ibid*. at § 303(n).
[92] *International Convention Concerning the Use of Broadcasting in the Cause of Peace*, 23 September 1936, L.N.T.S. 186 p. 301.
[93] *Universal Declaration of Human Rights*, GA Res. 217A(III), 3rd Sess., UN Doc. A/810 (1948) 71 at Article 19.
[94] *Supra* note 67 at § 325(a).
[95] *Ibid* at § 333.
[96] Matte, N.M., "Legal Issues of Satellite Broadcasting Services" (1982) Aerospace Law: Telecommunications Satellites at 197.

with this position when the transmission comes from space.[97] Prior consent by the receiving state is required for Direct Broadcast Services. Unlike terrestrial broadcasting, this capability is unbalanced between developed and developing countries. Therefore, sending states require prior consent for content transmitted to the receiving state. The right to license and regulate content is a domestic responsibility. ITU requires consultation and agreement between the states prior to broadcasting. Furthermore, overspill is to be limited to the extent possible.[98] In contrast, ITU Members generally recognize the right of the public to correspond, but it has no mechanism to address content control as the *Radio Regulations* are limited to technical issues.[99]

The FCC provides the domestic content regulations for the stations under its control. A highly visible form of content control to the public are the guidelines rating video programming that contains sexual, violent, or other indecent material under the *Telecommunications Act of 1996*. The FCC develops rules requiring distributors of such programming to enable parents to block the programming they determine is inappropriate for their children.[100] In contrast, the FCC shall not have the power of censorship over the radio communications or signals transmitted by any radio station, and no regulation or condition shall be promulgated which shall interfere with the right of free speech by means of radio communication.[101] And, broadcast licensees must promote political speech by permitting any legal candidate for public office to use licensed broadcasting stations and to afford an equal opportunity to the other candidates.[102]

Although much of the regulatory scheme applies to all radiocommunication activity, the FCC specifically regulates the following mass media services for commercial space activities: Direct Broadcast Satellite, Fixed Satellite Transmit/Receive Earth Stations, Small Transmit/Receive Earth Stations (2 meters or less and operating in the 4/6 GHz frequency band), Receive Only Earth Stations, Very Small Aperture Terminal

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[97] *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*, GA Res. 37/92, UN GAOR, 37th Sess., (1982) 98.
[98] *Radio Regulations*, *supra* note 12 at Article 523.13(4).
[99] *Constitution of the International Telecommunications Union*, 22 December 1992, 1825 UNTS 31251 [*ITU Constitution*] at Article 33.
[100] *Supra* note 67 at §§ 303(w) and 231.
[101] *Ibid.* at § 326.
[102] *Ibid*. at § 315(a).

(VSAT) Systems, Mobile Satellite Earth Stations, Radio determination Satellite Earth Stations, Space Stations, and Low-Earth Orbit Satellite Systems.[103]

Mass communication station licenses do not permit the licensee to operate their station nor use frequencies assigned beyond the terms of the license. Nor does the issuance of a license grant a right to assign or transfer a station in violation of the Act, which by implication includes treaty or convention provision.[104] No station license shall be transferred, assigned, or disposed of in any manner to any person except upon application to the FCC.[105] The term ‘‘media of mass communication’’ includes television, radio, cable television, multipoint distribution service, direct broadcast satellite service, and other services, the licensed facilities of which may be substantially devoted toward providing programming or other information services within the editorial control of the licensee.[106]

Congress grants the FCC exclusive jurisdiction to regulate “direct-to-home satellite services.” This term is defined as the distribution or broadcasting of programming or services by satellite directly to the subscriber’s premises without the use of ground receiving or distribution equipment, except at the subscriber’s premises or in the uplink process to the satellite.[107] Congress was careful to add that these regulations shall at a minimum prescribe that the political candidate’s access is guaranteed for this technology.[108] And, require providers to reserve between four and seven percent of its channel capacity for noncommercial educational or informational programming at reasonable prices, terms, and conditions.[109]

Government owned stations operated by the United States are not subject to the general provisions concerning frequency assignments and apparatus design. Government stations are to use such frequencies as assigned by the President. All government stations, except stations beyond the limits of the continental United States, when transmitting non-governmental business shall then conform to the regulations designed to prevent interference with other radio stations and the rights of others as the FCC

[103] *Ibid*. at § 158.
[104] *Ibid*. at § 309(h).
[105] *Ibid*. at § 310(d).
[106] *Ibid*. at § 309(i).
[107] *Ibid*. at § 303(v).
[108] *Ibid*. at § 335(a).
[109] *Ibid*. at § 335(b).

prescribes.[110] Additionally, the President may authorize a foreign government to construct and operate a fixed service station at or near the site of its embassy for transmission to points outside the United States. These foreign government stations shall conform to the regulations the President may prescribe.[111] However, the general rule is that no station license will be granted to or held by a foreign government or its representative.[112]

In the case of war, the President is authorized to direct that communications essential to national defense and security shall have priority with any carrier subject to the Act. Any carrier complying with such orders shall be exempt from all laws imposing civil or criminal penalties, obligations, or liabilities.[113] It is unlawful for any person during war to obstruct or retard interstate or foreign communication by radio or wire. The President is authorized to employ the armed forces to prevent such obstruction or retardation of communication.[114] Upon proclamation by the President in the case of war, national emergency, or to preserve the neutrality of the United States, the FCC may suspend or amend regulations applicable to all stations or devices capable of emitting electromagnetic radiations within the jurisdiction of the United States.[115]

Congress provided broad powers to the FCC to enforce the telecommunications Acts, treaties, and conventions. Under administrative procedures, the FCC may revoke a station license for false statements made in the application or any statement which may be required thereafter. Willful or repeated failure to operate as set forth in the license and willful or repeated violations of the Act or an FCC regulation authorized by the Act or treaty are forbidden.[116] A person who fails to operate a station in accordance with the conditions of the license, in violation of the Act or FCC regulation, may be ordered to cease and desist from such action.[117]

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[110] *Ibid*. at § 305(a).
[111] *Ibid*. at § 305(c).
[112] *Ibid*. at § 310(a).
[113] *Ibid*. at § 606(a).
[114] *Ibid*. at § 606(b).
[115] *Ibid*. at § 606(c).
[116] *Ibid*. at § 312(a).
[117] *Ibid*. at § 312(b).

Penal provisions and forfeitures[118] are provided for unauthorized publication. No person receiving or transmitting interstate or foreign communication by wire or radio shall divulge or publish the existence, contents, substance, purport, effect, or meaning thereof, except to the addressee, his agent, or attorney, or for proper accounting or distributing officers. No person having received any intercepted radio communication shall divulge or publish the existence, contents, substance, purport, effect, or meaning of such communication.[119] To enforce such provision, the District Courts of the United States have jurisdiction over criminal and civil cases brought before it by the Attorney General on behalf of the FCC. This includes actions alleging a failure to comply with or a violation of any of the provisions of this Act or the orders of the FCC.[120]

The philosophy of deregulation has been codified by Congress. It requires the FCC to review all regulations issued under the Act that apply to telecommunications service providers and to repeal those it determines are no longer in the public interest as the result of meaningful economic competition between providers of such service every even year.[121] A giant step towards privatization of space was taken by Congress to terminate the *Communications Satellite Act of 1962* and the transfer of assets to the successor entity of COMSAT.[122] The privatization of INTELSAT and Inmarsat[123] was found to be consistent with the principle of privatization encouraged by the FCC.[124] COMSAT no longer enjoys privileges or immunities under the laws of the United States on the basis of its status as a signatory of INTELSAT or Inmarsat. And only enjoys limited immunity to the extent any successor will not be liable for action taken by it in carrying out the instruction of the United States issued in connection with its relationships and activities with foreign governments, international entities, and the

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[118] *Ibid.* at § 401 (e)(1) (Any person who willfully violates subsection (a) shall be fined not more than $2,000 or imprisoned for not more than 6 months. (2) Any person who violates subsection (a) willfully and for purposes of direct or indirect commercial advantage or private financial gain shall be fined not more than $50,000 or imprisoned for not more than 2 years for the first conviction, and fined not more than $100,000 or imprisoned for not more than 5 years for subsequent conviction. (3) Any person aggrieved by any violation of subsection (a) may bring a civil action).
[119] *Ibid.* at § 605(a); See 18 U.S.C. § 2511(2) (authorizes interception in the course of a criminal investigation pursuant to a court order); See also, §§ 102(a)(4) and 105(f)(2)(C)) (authorizes electronic surveillance for foreign intelligence purposes).
[120] *Ibid.* at § 401(a).
[121] *Ibid.* at § 161.
[122] *Ibid.* at § 769(a)(18); See also §§ 731 et seq.
[123] *Ibid.* at § 769(a)(4)(A-B).
[124] *Ibid.* at § 765d.

intergovernmental satellite organizations.[125] And, the FCC will impose similar regulatory fees on the United States signatory which it imposes on other entities providing similar services. [126] Repealed is the preference in Federal Government procurement of telecommunications services, for the satellite space segment[127] provided by INTELSAT, Inmarsat, or any successor or separated[128] entity.[129] Users or providers of telecommunications services are permitted to obtain direct access to INTELSAT telecommunications services and space segment capacity through purchases of such capacity or services from INTELSAT.[130]

The FCC and satellite companies are held to the ITU procedures for technical coordination with INTELSAT and its successor entities and separated entities, rather than INTELSAT procedures.[131] The President is to pursue privatization through his representatives at the ITU.[132] To this end, the FCC is to ensure the United States remains the ITU notifying administration for the privatized INTELSAT's existing and future orbital slot registrations.[133] The FCC shall not assign orbital locations or spectrum by competitive bidding for the provision of international or global satellite communications services. The United States will oppose such in the ITU and in other bilateral and multilateral fora.[134]

In 2004, the FCC adopted rules to mitigate the amount of orbital debris potentially created by commercial satellite systems the United States authorizes. Under the rules, entities seeking approval for their operations in space must submit a plan showing that they have taken into account the possibility of their operations generating orbital debris and demonstrating that they have taken steps to mitigate that possibility. Earth station operators are required to submit this plan as part of their application for authorization.

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[125] *Contra* Francis Lyall, "Expanding Global Communications Services" (1999) Proceedings of the Workshop of Space Law in the 21th Century.
[126] *Ibid.* at § 765a.
[127] *Ibid.* at § 769(a)(10).
[128] *Ibid.* at § 769(a)(7-8).
[129] *Ibid.* at § 765b.
[130] *Ibid.* at § 765.
[131] *Ibid.* at § 765c(a).
[132] *Ibid.* at § 767.
[133] *Ibid.* at § 765c(b).
[134] *Ibid* .at § 765f.

The Satellite Division provides guidance on the content of orbital debris mitigation plans.[135]

The FCC's two-degree orbital spacing policy maximizes the number of satellites in orbit by ensuring that Fixed Satellite Service (FSS) satellites in geostationary-satellite orbit (GSO) can operate without causing harmful interference to other GSO FSS satellites located as close as two degrees away. Prior to the Commission's adoption of the two-degree spacing policy, GSO FSS satellites were usually spaced three or four degrees apart. By adopting rules that enabled satellite operators to place their space stations two degrees apart, the FCC was able to accommodate more GSO FSS satellites. The two-degree orbital spacing policy is important for earth station applicants because the FCC adopted a number of rules that would ensure that earth stations communicating with satellites at two-degree orbital separations would not cause unacceptable interference to adjacent satellite systems using the same frequency bands. These rules include earth station antenna diameter and performance requirements, and power restrictions.[136] Routine earth station applications comply with the two-degree spacing technical standards and are processed on an expedited basis. The FCC regulations allow expedited granting of earth station license applications seeking to communicate with GSO FSS satellites by way of fixed earth station antennas that are certain minimum sizes and which operate at power levels less than or equal to those specified. Routine earth station applications are also limited to the conventional C-band or Ku-band.[137]

The FCC's strategic goals include responsive regulation for the commercial environment, safety, and security. The goal for broadband is to give all Americans affordable access to robust and reliable broadband products and services. Competition in communications services is viewed as advantageous to the United States' economic development. A competitive framework for communications services will foster innovation and meaningful choice in affordable services. Media regulations will promote competition and diversity and facilitate the transition to digital modes of delivery. Public safety and homeland security requires communication capabilities during emergencies and crises must be available for public safety, health, defense, and emergency personnel,

[135] 47 C.F.R. § 25.114(d)(14).
[136] *Ibid*. at §§ 25.134, 25.209, 25.211, and 25.212.
[137] *Ibid*.

as well as all consumers in need. The communications infrastructure must be reliable, interoperable, redundant, and rapidly restorable.[138]

The FCC is the government body with the greatest active supervision of commercial space activity. The use of radio frequencies is essential to the operation of all space applications and requires coordination on a global basis to be effective. As a developed and pervasive regulatory regime of radio emissions and content controls, the FCC supervision extends beyond the radio spectrum use to address orbital location and debris mitigation. The FCC exercises continuing supervision of commercial activity and its objects placed into orbit through implementing the ITU regime. The FCC also supports the national interests by preserving the radio spectrum for governmental activity required for defense and security to be further addressed under the DOC. And, it is equally important for economic development by preserving the spectrum for commercial activity.

D. DEPARTMENT OF COMMERCE

> *No license shall be granted by the Secretary [of Commerce] unless the Secretary determines in writing that the applicant will comply with the requirements of this Act, any regulations issued pursuant to this Act, and any applicable international obligations and national security concerns of the United States.*
>
> -15 U.S.C. § 5621(b)(1)

The purpose of the Department of Commerce (DOC) is to foster, promote, and develop the foreign and domestic commerce and technology advancement of the United States. DOC was established in 1903 as a cabinet level department to participate with other government agencies in the creation of a national policy to promote job creation and improved living standards for all Americans by creating an infrastructure that promotes economic growth, technological competitiveness, and sustainable development. DOC consists of 12 operating units: National Telecommunications and Information Administration; National Oceanic & Atmospheric Administration; Bureau of Industry and Security; Economics and Statistics Administration; Bureau of the Census; Bureau of

[138] Federal Communications Commission, online: Federal Communications Commission <http://www.fcc.gov/omd/strategicplan/#goals>.

Economic Analysis; Economic Development Administration; International Trade Administration; Minority Business Development Agency; National Institute of Standards and Technology; National Technical Information Service; and, Patent and Trademark Office.[139]

The National Telecommunications and Information Administration (NTIA) was created in 1978 to be the President's principal adviser on telecommunications and information policy issues.[140] This requires close coordination with the FCC to represent the Executive Branch in both domestic and international telecommunications and information policy activities. NTIA implements policies to help American companies compete globally in the information technology and communications sectors. It also manages the government's use of the radio spectrum and the coordination and registration of government satellite networks.[141]

The National Oceanic & Atmospheric Administration (NOAA) was created in 1807 as the United States' first scientific agency for the purpose of surveying the coast. Its present purpose is to understand and predict changes in earth's environment and conserve and manage coastal and marine resources to meet economic, social, and environmental needs. Now best known for its national weather services, it operates a constellation of scientific and weather satellites. However, Congress expanded its role to include the promotion of commercial use of satellites and space to benefit the economy under the broader mandate of the DOC.[142] Congress authorized the Office of Space Commercialization to promote commercial provider investment in space activities, assist commercial providers to conduct business with the government, and ensure the government meet its space requirements by using commercially available space goods and services.[143] The office promotes the export of space goods and services through policies and negotiations with foreign countries to ensure free and fair trade in the area of space commerce. With the USAF, it coordinates the management of the Global

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[139] Department of Commerce, online: Department of Commerce <http://www.commerce.gov/>.
[140] See generally *National Telecommunications and Information Administration Organization Act*, 47 U.S.C. § 901 et seq.; See especially § 901(6); 47 C.F.R. Part III.
[141] Department of Commerce, online: National Telecommunications and Information Administration <http://ntia.doc.gov>.
[142] 15 U.S.C. § 1511e.
[143] Department of Commerce, online: Office of Space Commercialization <http://www.space.commerce.gov/>

Positioning System as a vital part of the economic infrastructure to promote its commercial application. It coordinates with other agencies to promote commercial remote sensing through acquiring government imagery needs from domestic commercial sources and representing the commercial sector interests in international negotiations.[144] It works closely with the DOT[145] and NASA[146] to promote the space transportation industry's assurance of government access to space.[147] And, it works to foster new market opportunities in near space by promoting RLV development. Like the FCC, Congress directs NOAA to seek every opportunity to remove legal, policy, and institutional impediments to space commerce.[148]

DOC exercises licensing authority over commercial remote sensing activities pursuant to the *Land Remote Sensing Policy Act of 1992*.[149] No person subject to the jurisdiction or control of the United States may operate any private remote sensing space system without a license granted under this Act. In making a licensing decision, DOC is obligated to consult with other departments and agencies. In the case of a private space system capable of other purposes; the authority of the DOC is limited to remote sensing operations. And, to promote commerce, Congress requires applications be acted upon within 120 days.[150] A license denial is not permitted in order to protect an existing licensee from competition.[151] DOC promulgates further regulations on remote sensing activities as appropriate under the authority of the Act.[152] A license shall only be granted after a written determination is made that the applicant will comply with the requirements of this Act, any regulations issued pursuant to this Act, and any applicable international obligations and national security concerns of the United States.[153]

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[144] The White House, *U.S. Commercial Remote Sensing Policy* (2003).
[145] Memorandum of Understanding Between Office of Commercial Space Transportation, Federal Aviation Administration, U.S. Department of Transportation, and Office of Space Commercialization, National Environmental Satellite, Data, and Information Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, (2007).
[146] Commercial Orbital Transportation Services program to develop commercial access to the International Space Station after the Space Shuttle program terminates.
[147] The White House, *U.S. Space Transportation Policy* (2005).
[148] 15 U.S.C. § 1511e(c); § 5625(b).
[149] *Ibid*. at §§ 5621 et seq.
[150] *Ibid*. at § 5621(c).
[151] *Ibid*. at § 5621(d).
[152] *Ibid*. at § 5624.
[153] *Ibid*. at § 5621(b).

DOC's continuing supervision requirements call for its licensees to operate the system in such manner as to preserve national security and to observe international obligations.[154] Licenses must make available to governments unenhanced data collected concerning their territory as soon as such data are available and on reasonable terms and conditions.[155] This provision implements in part the *Principles Relating to Remote Sensing of the Earth from Outer Space* which requires that all unenhanced data be made available to the United States regardless of the territory sensed.[156] Licensees are required to furnish DOC with the complete orbit and data collection characteristics of the system and make immediate notification of any deviation.[157] Notification of any significant or substantial agreement the licensee intends to enter with a foreign nation, entity, or consortium is required as well and licenses must[158] maintain shutter control in support of national security and foreign policy interests. Upon termination of operations, the licensee is to dispose of the satellite in a manner satisfactory to the President.[159]

To accomplish its continuing supervision responsibilities, DOC is empowered to grant, condition, or transfer licenses.[160] The DOC may obtain an order of injunction or similar judicial determination from a District Court with personal jurisdiction over the licensee to terminate, modify, or suspend licenses on an immediate basis, if the licensee has substantially failed to comply with any provision of this Act, terms of such license, or with any international obligations or national security concerns of the United States.[161] Penalties are provided for noncompliance with the requirements of licenses or regulations, including civil penalties up to $10,000 each day of operation in violation of such licenses or regulations.[162] It will also issue subpoenas for any materials,[163] seize any object pursuant to a warrant from a magistrate judge,[164] and make investigations and

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[154] *Ibid*. at § 5622(b)(1).
[155] *Ibid*. at § 5622(b)(2).
[156] *Ibid*. at § 5622(b)(3); *Contra Principles Relating to Remote Sensing of the Earth from Outer Space*, GA Res. 41/65, UN GAOR, 41st Sess., UN Doc. A/RES/41/65 (1986) 115 (not all provisions implemented, see restrictions on data sharing).
[157] *Ibid*. at § 5622(b)(5).
[158] *Ibid*. at § 5622(b)(6).
[159] *Ibid*. at § 5622(b)(4).
[160] *Ibid*. at §5623(a)(1).
[161] *Ibid*. at § 5623(a)(2).
[162] *Ibid*. at § 5623(3).
[163] *Ibid*. at § 5623(5).
[164] *Ibid*. at § 5623(6).

inquiries.[165] However, nothing in this Act shall contradict the authority of the FCC pursuant to the *Communications Act of 1934*.[166]

The *U.S. Commercial Remote Sensing Policy* directs DOC to provide timely and responsive regulations for licensing the operations and exports of commercial remote sensing space systems in order to balance the competing interest of defense and security against economic development, while also meeting its broader obligation of continuing supervision. The policy recognizes the roles of the Secretary of Defense and the Secretary of State to protect national security and foreign policy concerns through coordination with DOC and encourages domestic companies to build and operate commercial remote sensing space systems whose operational capabilities, products, and services are superior to any current or planned foreign commercial systems. To accomplish these disparate goals, the government procures its remote sensing needs from the commercial providers and in turn restricts the collection and dissemination of certain data and products to other customers. The government considers remote sensing exports on a case-by-case basis pursuant to DOC's Commerce Control List[167] and the DOS's United States Munitions List to implement these export controls.[168]

DOC implements continuing supervision by promoting remote sensing data access to peaceful states while restricting data to non-peaceful ones. Its supervision chiefly occurs through tracking the location of remote sensing systems and the receipt of all data obtained. And this authority continues for the life of the system to include transfers until the disposal of the satellite pursuant to the direction of the President. The domestic interests promoted may be viewed as paradoxical in that they promote commercial applications for economic development while restricting similar data for security purposes. As DOC's mandate is to promote the nation's economic development, coordination through other departments retard this purpose to balance the defense and security interests. For example, the split in authority to exercise export controls over

[165] *Ibid*. at § 5623(7).
[166] *Ibid*. at § 5625(e).
[167] *Commerce Control List*, 15 C.F.R. §§ 738.1 et seq.
[168] *United States Munitions List*, 22 C.F.R. §§ 121.1 et seq.

space applications with the DOS addressed below significantly limits the commercial potential of space applications involving domestic manufacturers or technology.[169]

E. DEPARTMENT OF DEFENSE

> *The Secretary of Defense may carry out a pilot program to determine the feasibility and desirability of providing to non-United States Government entities space surveillance data.*
>
> -10 U.S.C. 2274(a)

The purpose of the Department of Defense (DOD) is to provide for the national defense and was reorganized for this purpose by the *National Security Act of 1947*.[170] The cabinet level head of this department is the Secretary of Defense who oversees the Joint Chiefs of Staff, Department of the Army, Department of the Navy, Department of the Air Force (USAF), unified and specified combatant commands, Defense Agencies, Department of Defense Field Activities, and such other offices, agencies, activities, and commands as established by law or the President.[171] DOD space programs are located throughout this large and complicated structure. The principle of jointness underlying the 1947 reorganization complicates the task of ascertaining the responsible office for a given program.[172] To understand DOD, one must be aware of the two layers of organization Congress created in fashioning a joint force. First, geographic[173] and functional[174] joint commands conduct the military operations directed by the President or the Secretary. The geographic and functional commands rely on the personnel and equipment provided by the separate armed services at the direction of the President or Secretary. Second, the five uniformed services[175] organized into three departments train and equip the forces necessary for these missions. Space applications are the primary responsibility of the

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[169] Export Administration Act, 50 U.S.C. Appx 2401 et seq. [expired but continued under Executive Order on 17 August 2001]; *Cox Report*, *supra* note 17.
[170] *National Security Act of 1947*, 10 U.S.C. §§ 101 et seq.
[171] *Ibid*. at § 111.
[172] Department of Defense, online: <http://www.defenselink.mil/odam/omp/pubs/GuideBook/ToC.htm>.
[173] Africa Command, Central Command, European Command, Northern Command, Pacific Command, and Southern Command.
[174] Joint Forces Command, Special Operations Command, Strategic Command, and Transportation Command.
[175] United States Army, United States Air Force, and United States Navy which administers the United States Marine Corps and during wartime operations administers the United States Coast Guard which is a component of the Department of Homeland Security.

United States Strategic Command, a functional command as it is not responsible for a specific geographic area and supports the needs of all other commands through its space applications. The service providing the majority of space personnel and equipment is the USAF.[176]

The USAF likewise is divided into major commands[177] with Air Force Space Command (AFSPC) mission to deliver space and missile capabilities to America and its warfighting commands. AFSPC works closely with commercial space providers to purchase space services to include launch vehicles and satellites. AFSPC also cooperates with space providers by providing ranges, export control security, and coordination with other departments and agencies on export decisions. The National Reconnaissance Office is the USAF's chief partner in providing space applications to the national security establishment.

The National Security Space Office (NSSO) was established in 2004 in response to the *Rumsfeld Report*.[178] It found that a number of issues transcend the multiple organizations within the national security establishment that would benefit by an interagency body to coordinate its collective defense, intelligence, civil, and commercial space activities. Of these issues, the revision of national space policy to address the security needs of the United States and a sound acquisition strategy to support this policy rated high.[179] The DOD and the Intelligence Community together acquire and operate most of the satellites used to support national security. NSSO is to improve disparate acquisition processes developed by the USAF and the National Reconnaissance Office. It is currently addressing the need for operationally responsive space access, coordination of the multiple uses of the current and future Global Positioning Satellite constellation, and research on future Space-Based Solar Power.[180]

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[176] Department of Defense, *Joint Publication 0-2 Unified Action Armed Forces* (2001).
[177] Air Combat Command, Air Education and Training Command, Air Force Cyber Command, Air Force Materiel Command, Air Force Reserve Command, Air Force Space Command, Air Force Special Operations Command, Air Mobility Command, United States Air Forces in Europe, and United States Pacific Air Forces.
[178] *Rumsfeld Report*, *supra* note 6.
[179] *U.S. National Space Policy*, *supra* note 4; *U.S. Space Transportation policy*, *supra* note 8.
[180] National Security Space Office, online: National Security Space Office <http://www.acq.osd.mil/nsso/index.htm>.

The *Rumsfeld Report* recognizes that the commercial sector is critical to the success of the national security mission and requires a comprehensive approach to incorporate its capabilities and services into the national security space architecture. The United States Government as a consumer, regulator, and investor can improve its partnership with the space industry by creating a more expeditious licensing process while safeguarding security interests, rely on commercial space services to meet security requirements, privatize government launch facilities, and foster multinational alliances to help maintain the United States' position as a leader in the space market.[181]

In fact, Congress requires AFSPC and NASA to coordinate to ensure that the United States has the capability to launch and insert national security payloads into space whenever needed.[182] To accomplish this requirement, it must sustain the availability of at least two space launch vehicles and a robust space launch infrastructure and industrial base.[183] Furthermore, it is to establish an Operationally Responsive Space Program Office to develop low-cost, rapid reaction payloads, busses, spacelift, and launch control capabilities.[184]

DOD's impact on commercial space is significant in that it is one of its largest customers and is now beginning to provide limited traffic management services to commercial operators. A central aspect to continuing supervision is the physical tracking of commercial spacecraft while in orbit. The concept of Space Traffic Management has been discussed academically,[185] but the primary source of traffic data is the AFSPC. The Commercial and Foreign Entities (CFE) is a pilot program implemented by AFSPC to provide satellite tracking support to entities outside the United States Government.[186] Unlike the FAA which limits its involvement in traffic management at the borders of the national airspace, CFE tracks items in orbit and reports possible conflicts with a variety of messages. CFE distributes Two Line Elements (TLEs), satellite catalog messages, satellite decay messages, Project TIP messages, and other messages previously issued by

[181] *Supra* note 6 at 25-28.
[182] 10 U.S.C. § 2273 (a).
[183] *Ibid*. at § 2273 (b)(1-2).
[184] *Ibid*. at § 2273a.
[185] Corinne Contant-Jorgenson et al., "Cosmic Study on Space Traffic Management" (Paper prepared for the International Academy of Astronautics, 2006); William Marshall et al., "Space Traffic Management" (Paper presented by International Space University summer session at Beijing, 2007).
[186] 10 U.S.C. § 2274.

the NASA Orbital Information Group (OIG). Congress authorized AFSPC's CFE program through September 2009.[187] As AFSPC was the source of NASA's OIG data, this move takes NASA out of the distribution chain to commercial and foreign entities.

The goal of the CFE pilot program is to determine the feasibility and desirability of providing to non-United States Government entities space surveillance data and analysis support.[188] The space surveillance data and analysis is derived from military satellite tracking services operated by DOD and provided to outside entities subject to the national security interests.[189] Eligible entities include local domestic governments,[190] domestic commercial entities,[191] governments of foreign countries,[192] and foreign commercial entities.[193] This service is provided on the condition that the recipient agrees not to transfer any data or technical information received without the express approval of DOD.[194] Congress authorized AFSPC to charge a fee[195] for this service and to outsource this service to a private contractor.[196] It is too soon to determine how this pilot project will develop. But for now, the SSA system of the DOD provides the most reliable data set for space traffic management.

DOD also provides the United States with the ultimate power of supervision most recently displayed in February 2008 in its ability to physically disable or destroy a spacecraft.[197] Although it is the sole department with the capability to exercise the ultimate government supervision by way of destruction of the space or ground segment, its role in supervision is expanding. DOD's role in continuing supervision prior to 2003 had been primarily one of coordination with the other departments. Now it is entering the domain of Space Traffic Management slowly as Congress recognizes the critical role of SSA in the defense of the space based global utilities critical to both economic and security interests. The growing ability to track objects in orbit in real time and the

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[187] *Ibid*. at § 2274(i).
[188] *Ibid*. at § 2274(a).
[189] *Ibid*. at § 2274(b).
[190] *Ibid*. at § 2274(c)(1-2).
[191] *Ibid*. at § 2274(c)(3).
[192] *Ibid*. at § 2274(c)(4).
[193] *Ibid*. at § 2274(c)(5).
[194] *Ibid*. at § 2274(d)(2).
[195] *Ibid*. at § 2274(f-g).
[196] *Ibid*. at § 2274(h).
[197] Thom Shanker, "Missile Strikes a Spy Satellite Falling From Its Orbit" *The New York Times* (21 February 2008).

advancement of maneuvering technology will create a robust environment akin to that of the air space managed by the FAA. In the meantime, the national security interest will drive DOD's observation role.

As the largest customer of commercial space providers, DOD now supplements its space capabilities with systems operated by civil agencies and commercial entities. These space systems are owned and operated by the civil agency, corporation, or international consortium, but USSTRATCOM establishes agreements and working relationships with organizations such as NASA, NRO, NOAA, Intelsat and Inmarsat to increase its security capabilities.[198] The challenge to this dependence is to prevent the STRATCOM Commander from losing his military authority over these vital security assets and reduced to a consumer standing in queue for a scare commodity. What is being touted as a beneficial relationship between DOD and the commercial space sector will become more challenging for DOD as the most capable space application providers become more international. And ultimately, DOD may find itself in queue for space services with its adversary.[199]

In summary, the supervision function by DOD is primarily one of coordination with other departments to ensure national security is not adversely affected by the commercial activity. Its role has expanded to include providing a space monitoring service to participating commercial providers with the possibility it may grow into a space traffic management function analogous of air traffic control. DOD has a unique relationship with these providers as the largest consumer of commercial space goods and services. The future of this partnership will evolve as export controls and the domestic supervision regime significantly affect the development of this sector. In the short term, its implementation of national interests includes providing for national security and supporting economic development of the space sector.

[198] Department of Defense, *Joint Publication 3-14 Joint Doctrine for Space Operations* (2002) at II-7.
[199] *Ibid.* at III-1.

F. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

> *The Congress declares that the general welfare of the United States requires that the National Aeronautics and Space Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space.*
>
> -42 U.S.C. § 2451(c)

The purpose of the National Aeronautical and Space Administration (NASA) is responsible for all aeronautical and space activities sponsored by the United States, except those associated weapons systems, military operations, or the defense of the United States.[200] Established in 1958[201] after the launch of Sputnik its present objectives include supporting the preeminence of the United States' commercial operators and manufacturers, expand our knowledge of the space environment, and support the national security needs.[202]

Increased reliance upon commercial manufacturers and operators is one of NASA's strategic goals.[203] NASA encourages the pursuit of partnerships with the emerging commercial space sector. NASA has historically supported commercial activity with its support to communications satellites beginning in the 1960s, its procurement of launches services, and most recently the Ansari X-Prize. NASA now plans to seek the commercial space sector's support to accomplish its core mission of discovery through the Commercial Crew/Cargo Project for its access to the International Space Station after the retirement of the Space Shuttle. With the outlook to encourage

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[200] 42 U.S.C. § 2451(b).
[201] *National Aeronautics and Space Act of 1958 as amended,* 42 U.S.C. §§ 2451 et seq.
[202] 42 U.S.C. § 2451 (d) [NASA] objectives: (1) The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space; (2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles; (3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space; (4) The establishment of long-range studies of the potential benefits ... of aeronautical and space activities for peaceful and scientific purposes; (5) The preservation of the role of the United States as a leader in aeronautical and space science and technology … to the conduct of peaceful activities within and outside the atmosphere; (6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance…; (7) Cooperation by the United States with other nations … in work done pursuant to this Act …;(8) The most effective utilization of the scientific and engineering resources …in order to avoid unnecessary duplication of effort, facilities, and equipment; and (9) The preservation of the United States' preeminent position in aeronautics and space… manufacturing…
[203] National Aeronautics and Space Administration, *2006 NASA Strategic Plan* (2006) (Strategic Goal 5).

the domestic commercial space sector through competitions to develop space applications in support of more ambitious goals to the moon and human space flight.[204]

NASA is the leading government agency in the area of debris mitigation. To control the growth rate of orbital debris, it developed its own guidelines[205] in the 1990s and has since coordinated the expansion of debris mitigation procedures throughout the United States Government[206] and the major space faring nations[207] to preserve the near earth space environment for future space activity. These mitigation procedures range from preventing the creation of new debris through spacecraft designed to withstand the impact of small debris, launch vehicles designed to reduce unnecessary debris separation, and operational procedures which place satellites in orbits with less debris, maneuverability to avoid collisions, and a disposal plan for the end of the spacecrafts' lives. Towards this end, Debris Assessment Software was created by NASA to standardize its analysis in order to evaluate the impact which designs and operations will have on debris growth. This software is made available to manufactures and operators to assess whether a program meets the established debris mitigation standards.[208]

Export controls are a significant challenge to NASA as an agency tasked with encouraging commercial development and international cooperation on space activities.[209] NASA created the Export Control Program (CEP) to educate its employees on the export control laws and regulations of the United States and to monitor its compliance. The wide scope of the *Export Administration Regulations*[210] and *International Traffic in Arms Regulations*[211] make such a program necessary to prevent

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[204] *Ibid.*
[205] National Aeronautics and Space Administration, *NPR 8715.6A NASA Procedural Requirements for Limiting Orbital Debris* (2008), online: NASA Orbital Debris Program Office <http://orbitaldebris.jsc.nasa.gov/mitigate/mitigation.html>.
[206] ___. *U.S. Government Orbital Debris Mitigation Standard Practices* (1997) online: NASA Orbital Debris Program Office < http://orbitaldebris.jsc.nasa.gov/mitigate/mitigation.html>.
[207] Inter-Agency Debris Coordination Committee, IADC Space Debris Mitigation Guidelines (2007), online: Inter-Agency Space Debris Coordination Committee <http://www.iadconline.org/> [*IADC Guidelines*].
[208] National Aeronautics and Space Administration, online: NASA Orbital Debris Program Office < http://orbitaldebris.jsc.nasa.gov/mitigate/mitigation.html>.
[209] 42 U.S.C. § 2452(b).
[210] *Export Administrative Regulations*, 15 C.F.R. §§ 730 et seq.
[211] *International Traffic in Arms Regulations*, 22 C.F.R. §§ 120 et seq.

violations and, more importantly, to reduce the spread of missile technologies to irresponsible states.[212]

In summary, NASA's role in continuing supervision is strongly affected by its promotion of innovation and its position as a large consumer. As the originator of the space debris mitigation policies, it shaped the binding debris limitation regulations exercised through DOT and DOC. And, its contract requirements strongly influence the prevailing state practices through its leverage as the lead agency in the International Space Station. The national interests advanced are economic through its implementation of the transportation policy and coordination with other agencies.

G. DEPARTMENT OF STATE

> *The Secretary of State, in consultation with the Secretary of Defense and the heads of other appropriate departments and agencies, shall establish and maintain, as part of the United States Munitions List, a list of all items on the MTCR Annex, the export of which is not controlled under … the Export Administration Act of 1979.*
>
> -22 U.S.C. § 2797(a)

The Department of State (DOS) was established in 1879[213] to represent the United States in its diplomatic relations and to implement the President's international policies.[214] DOS's most recent mission statement recognizes the need for a more democratic, secure, and prosperous world and the role of state responsibility for its people and the international community.[215] The *Strategic Plan* focuses on security and is aware of the role of the global economy in achieving its goal.

The Space and Advanced Technology (SAT) staff address the international space issues, and the science and advanced technology questions for the DOS. This office represents the DOS in interagency decisions and then presents the United States' position before UNCOPUOS. SAT also implements the *Registration Convention* by maintaining

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[212] National Aeronautics and Space Administration, *NASA Administrator's Export Control Policy Statement* online: Export Control Program Office <http://www.hq.nasa.gov/office/oer/nasaecp/> (accessed 21 June 2008).
[213] 22 U.S.C. § 2651.
[214] *U.S. National Security Strategy*, *supra* note 4.
[215] Department of State, *Strategic Plan: Fiscal Years 2007–2012* (2007).

the national registry of objects launched into outer space[216] and provides the Secretary General of the United Nations quarterly updates to the United Nation's registry.[217] And, SAT reviews export license requests for space technology. Its goals are to protect the competitiveness of the commercial space sector, preserve the environment, and protect national security.[218]

The Office of Defense Trade Controls (ODTC) directly administers the export controls for the DOS. ODTC's purpose is to develop and maintain security relationships with other countries and international organizations through defense trade and export control regimes.[219] The *Arms Export Control Act*[220] is administered by the DOS in concert with the *Export Administration Act*[221] by DOC. The DOS implements[222] the multiple export controls arrangements affecting space goods and technology through ITARs.[223] Briefly in the 1990s, DOC exercised control over propulsion systems, space vehicles, and related equipment under the Commerce Control List[224] in an effort to better promote the domestic commercial space sector.[225] Congress redirected space trade to the DOS after it found that the need for security outweighed the benefits of expedited trade following two significant security lapses with China.[226] Congress determined that satellites are more properly controlled under the United States Munitions List (USML)[227]

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[216] Department of State, *U.S. Space Objects Registry*, online: Space and Advanced Technology Staff <http://www.usspaceobjectsregistry.state.gov/>.
[217] United Nations Office for Outer Space Affairs, *Registry Search* online: Office for Outer Space Affairs <http://www.unoosa.org/oosa/showSearch.do>.
[218] Department of State, online: Bureau of Oceans and International Environmental and Scientific Affairs < http://www.state.gov/g/oes/sat/>.
[219] *Supra* note 207 at 13-14.
[220] *Arms Export Control Act*, 22 U.S.C. §§ 2751 et seq.
[221] *Supra* note 160.
[222] 22 U.S.C. § 2778(a)(1).
[223] 22 C.F.R. §§ 120 et seq.
[224] 15 C.F.R. §§ 730 et seq.
[225] John Mintz "2 U.S. space giants accused of aiding China Hughes, Boeing allegedly gave away missile technology illegally" *Washington Post* (1 January 2003).
[226] United States House of Representatives, *U.S. National Security and Military/Commercial Concerns with the People's Republic of China* (1999) online: House of Representatives <www.house.gov/coxreport/> [*Cox Report*] (In the aftermath of three failed satellite launches between 1992 and 1995, the U.S. satellite manufacturers Hughes and Loral transferred missile design information and know-how to China. The illegally transmitted information is useful for the design and improved reliability of future Chinese ballistic missiles).
[227] *United States Munitions* List 22 C.F.R. Part 121 (USML has XXI categories: Category IV Launch Vehicles, Guided Missiles, Ballistic Missiles, Rockets, Torpedoes, Bombs, and Mines and Category XV Spacecraft Systems and Associated Equipment).

due to the inherent relationship such technology has to strategic weapons capability. The USML implements the MTCR through its inclusion of all Category I and II items.[228]

All producers of ITAR goods and technologies are required to register with ODTC even if they do not engage in exports.[229] Sales and transfers are controlled through licenses and any sale exceeding $50 million requires Congressional notification.[230] Besides intra-agency coordination, ODTC coordinates licensing decisions with offices outside the DOS to include the DOD[231] and other agencies[232] as required. Even to enter into discussions with a foreign entity on an ITAR product or service, the commercial providers must obtain permission in advance. This data includes information relevant to the design, development, production, manufacture, assembly, operation, repair, testing, maintenance, or modification of defense articles, or classified information relating to them.[233] To conduct such discussions the ODTC may issue a Technical Assistance Agreement (TAA) after appropriate coordination with the affected agencies.[234]

Once a sale or service is approved, safeguards to prevent unauthorized disclosures are documented in a Technology Transfer Control Plan (TTCP) and an Encryption Technology Control Plan (ETCP) if applicable, which requires extensive coordination with DOD's Defense Threat Reduction Agency. Monitoring and continuing approvals are required through the life of a transfer creating frequent delays for the project. Even in the case of a failed launch of an approved satellite, a sale requires an independent TAA in advance of the accident investigation in the fear that technology may be transferred in the resulting discussions of the potential causes of the launch failure. And, the resulting insurance claim must be reviewed to ensure technical data is not disclosed.[235] These provisions are enforced through criminal and civil Sanctions.[236]

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[228] 22 U.S.C. § 2797(a); 22 C.F.R. § 121.16.
[229] 22 U.S.C. § 2778(b); 22 C.F.R. Part 122.
[230] 22 U.S.C. § 2797(d).
[231] *Ibid.* § 2797(b)(1).
[232] See e.g. 15 U.S.C. 5621(a) (DOC) and 49 U.S.C. § 70116 (DOT).
[233] 22 C.F.R. § 120.10.
[234] 22 C.F.R. Part 125.
[235] Department of State, online: Directorate of Defense Trade Controls <http://pmddtc.state.gov/personnel.htm>.
[236] 22 U.S.C. § 2778(c) (criminal sanction $1 million fine and 10 years); § 2797a (civil sanction against nationals); § 2797b (civil sanction against foreigner); 22 C.F.R. Part 127.

The impact of export controls on the commercial space sector is debated by the government agencies providing oversight,[237] and the commercial providers and academic researchers are retarded in their efforts to advance space development. What is clear is that foreign providers are advertising their space products as ITAR free and even allied governments who are members of the export control arrangements discussed in Chapter II are taking steps to avoid ITAR entanglements.[238] The ITAR taint which results from a non-uniform implementation of international export control arrangements is a growing impediment to the United States commercial development and national security in the long run. The commercial space sector must choose between government contract work or purely commercial projects. This hobbesian choice reduces the market opportunities for business and makes fewer technology options available for national security.[239] Indirectly this trend may also harm space safety as ITAR free launches will not benefit from the United States Government's debris mitigation guidelines.

The DOS's role in continuing supervision is primarily concerned with arms control compliance. This aspect of supervision is difficult to balance with the competing interest to promote space use by other Parties to the *Outer Space Treaty* and the national interests in economic development. The DOS and DOC must coordinate their efforts to accomplish both interests.

In conclusion, the implementation of continuing supervision by the United States is complicated by the national interests woven into its commercial space regime. The mere establishment of an obligation to exercise supervision alone is not effective in assuring the interests of the Parties to the *Outer Space Treaty*. Future international space supervision standards are the critical link between the establishment of this obligation and assuring a safe and secure space environment to the space faring states. As the private sector grows, space activity outside the government domain requires implementation of standards by which to measure the conduct of these private actors. The next chapter examines the way ahead for creating supervision standards and conclusion.

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[237] Government Accountability Office, *Export Controls: Vulnerabilities and Inefficiencies Undermine System's Ability to Protect U.S. Interests* (GAO-07-1135T) (26 July 2007).
[238] Michael Bruno, "Now Is Best Chance To Remake U.S. Export Controls" *Aviation Week* (6 September 2007).
[239] Peter B. de Selding, "European Satellite Component Maker Says It is Dropping U.S. Components Because of ITAR" *Space News* (13 June 2005).

IV. CONCLUSION

A. Development of Supervision

> *Every State shall effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag…*
>
> -*Law of the Sea*, Article 94

> *Each contracting State undertakes to adopt measures to insure that every aircraft flying over or maneuvering within its territory and that every aircraft carrying its nationality mark, wherever such aircraft may be, shall comply with the rules and regulations relating to the flight and maneuver of aircraft there in force. Each contracting State undertakes to keep its own regulations in these respects uniform, to the greatest possible extent, with those established from time to time under this Convention. Over the high seas, the rules in force shall be those established under this Convention. Each contracting State undertakes to insure the prosecution of all persons violating the regulations applicable.*
>
> -*Chicago Convention*, Article 12

> *Ratification … of this Constitution … shall also constitute consent to be bound by the Administrative Regulations adopted by competent world conferences prior to the date of signature … .*
>
> -*ITU Constitution*, Article 54

Continuing supervision as expressed in the *Declaration of Legal Principles Governing the Activities of States in Outer Space*[1] and made binding by the *Outer Space Treaty*[2] is the linchpin that connects the principles of the space legal regime to non-governmental entities. This condition is exposed during the space age's transition from its infancy under the strict control of the technocratic state to its emancipation through privatization. The trend toward commercial space operations in an environment not capable of being governed by a single state and the ever growing reliance by the world economy on space applications begs the question: Who is supervising the new generation of space actors? The *Review of existing national space legislation illustrating how States are implementing, as appropriate, their responsibilities to authorize and*

[1] *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interests of All States, Taking into Particular Account the Needs of Developing Countries*, GA Res. 51/122, UN GAOR, 51st Sess., Supp. No. 20, UN Doc. A/51/20 (1996).
[2] *Treaty Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 27 January 1967, 610 U.N.T.S. 205, 18 U.S.T. 2410 [*Outer Space Treaty*].

provide continuing supervision of non-governmental entities in outer space[3] establishes a lack of state supervision and the imploring *Application of the Concept of the "Launching State"*[4] is unlikely to fill the lacunae in the near term. Meanwhile, the stop gap measures of the International Telecommunication Union has carried space supervision to the extent required not to spoil terrestrial radio communications by creating binding standards[5] concerning the use of radio frequencies to and from space stations.[6]

B. Proposed Standards for Supervision

> *Space traffic management means the set of technical and regulatory provision for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio frequency interference.*
>
> *-Cosmic Report*

The lack of minimal standards for the implementation of continuing supervision is recognized as an impediment to future space development and use. Forward thinkers espoused the development of traffic rules for outer space since discussions of space law began in earnest.[7] Again in the 1980s, a proposal to begin outlining space traffic rules to address the safety issues of physical and radio frequency interference, debris mitigation, space situation awareness, and reliability were recommended with an implementation goal by the turn of the millennium.[8] Even then it was acknowledged that the proliferation

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[3] *Review of existing national space legislation illustrating how States are implementing, as appropriate, their responsibilities to authorize and provide continuing supervision of non-governmental entities in outer space*, UNCOPUOS, 40th Sess., UN Doc. A/AC105/C.2/L.224 (2001).
[4] *Application of the Concept of the "Launching State"*, GA Res. 59/115, UN GAOR, 59th Sess., UN Doc. A/RES/59/115 (2004).
[5] *Constitution of the International Telecommunications Union*, 22 December 1992, 1825 U.N.T.S. 31251 [*ITU Constitution*] at Article 54.
[6] *Ibid.* at Article 44.
[7] McDougal, Walter A., Myres S., Lasswell, Harold D. & Vlasic, Ivan A., *Law and Public Order in Space* (New Haven and London: Yale University Press, 1963) at c 5 ("In this chapter, it will be seen that the nationality of spacecraft is particularly important for the allocation of responsibility with respect to the observance of certain standards and practices designed to secure safe and ordered navigation in the land-air-space continuum…").
[8] Luboš Perek, "Traffic Rules of Outer Space" (1982) 82-IISL-09 ("We have had experience [mostly negative and from hindsight] with pollution of the earth, of rivers, of seas and even of the world's ocean. Do we have also to pollute circumterrestrial outer space or have we already learned the lesson? We also experience with road traffic, traffic at sea and air traffic. Although space travel is in many respects different from travel in the first three environments, we can profitably study general ideas underlying existing traffic regulation with a view to apply them to traffic in the fourth environment...Why are we talking about traffic rules already now? Because, as the old saying goes, prevention is better than cure.").

of launching states and private entities spurred on by market forces would benefit by the adoption of an international agreement on the standards for conducting space activities.[9] The logic then was that an ounce of prevention would be worth a pound of cure when considering that the cost of remediation is measured in billions and lifetimes.

Resuming in 2001, the topic of space traffic management gained popularity as the *big bang* approach to updating space law.[10] This agenda item is the answer to all space law advocates who are seeking to implement new regulations on space activity.[11] But at its heart, space traffic management is a set of minimal standards to ensure responsible conduct in outer space as is required in other international commons.[12] Attempts to strengthen national space administration laws and regulations in an effort to implement Article VI of the *Outer Space Treaty* have resulted in little progress. The sole State Party with a truly comprehensive supervisory scheme is the United States. But even the United States Space and Air Traffic Management System (SATMS)[13] limits its reach to the boundaries of the national airspace. And, the impetus of much national space regulation is domestic interest rather than a design to implement its international obligation. The resulting debris mitigation guidelines, commercial launch regulations, and liability insurance requirements are models followed by other space faring states. But even areas in which consensus is present, implementation by the major space faring states is hit or miss.[14]

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[9] Ibid. at 41.

[10] Kai-Uwe Schrogl, Space Traffic Management, The new comprehensive approach for regulating the use of outer space, European Space Policy Institute, ESPI Flash Report #3. (2007).

[11] Michael Katz-Hyman, "Proximity Operations in Space, The Case for a Code of Conduct" (2006) International Network of Engineers and Scientists Against Proliferation, Bulletin 26 ("Codes of conduct, or rules of the road, are well tested methods to codify what many times are de facto behaviors of responsible actors. From local traffic laws to international agreements on responsible handling of missile components, codes and rules promote responsible behaviors while clarifying those rules which are inappropriate to break").

[12] *Convention on International Civil Aviation*, 7 December 1944, 61 U.N.T.S. 1180, 61 U.S. Stat. 1180 [*Chicago Convention*]; *United Nations Convention on the Law of the Sea*, 10 December 1982, 1833 U.N.T.S. 3, 12 I.L.M. 1261 [*Law of the Sea*]; *ITU Constitution, supra* note 5; International Telecommunication Union Radio Regulations [*Radio Regulations*]; *Antarctic Treaty*, 1 December 1959, 402 U.N.T.S. 71, 12 U.S.T. 794.

[13] Federal Aviation Administration, *Concept of Operations for Commercial Space Transportation in the National Airspace System Narrative, Version 2.0* (2001); ___. *Concept of Operations for Commercial Space Transportation in the National Airspace System, Addendum 1: Operational Description* (2005).

[14] *Supra* note 3.

At present, the proposal to empower or create an international body to produce binding technical standards applicable to all space activity has gained traction in the non-governmental organization and academic circles. The most notable publication is the *Cosmic Study*.[15] It predicts that the urgency for a space traffic management regime will be reached in the next two decades, and it provides an orientation for other researchers to develop the technical and regulatory competencies necessary to create such a regime. The methodology of this proposal has been to consolidate the space initiatives of other bodies into one organization and count on the participation derived by the coercive power of the major space faring states over their national space activity. The immediate problem for this approach is the lack of support by the major space faring states.

Any space traffic management body must address the three trends earlier identified as commercialization, safety, and security in order to be effective. The commercial space operators must be bound to this new standard setting regime. The bodies governing other international commons had the benefit of controlling access to the most lucrative routes and destinations through the national administrations of participating states. For private entities not so constrained due to the spread of ballistic missile technology and the versatility of global enterprises, the temptation to operate beyond such restrictions imposed by this body will exist, and particularly for those whose objective is anything other than the long term safety and security of the space environment.[16] The value derived from the unique relationship between orbital positions and the radio frequency is required to operate accounts for the high participation of the commercial sector in the International Telecommunications Union.[17] A new space standards body will enjoy greater participation by using the *pull strategy* (marketing concept) through the creation of value to the private entity while also advancing the general good through good governance of the space environment. This can occur through either controlling an essential aspect of space operations[18] or offering a valuable space

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[15] Corinne Contant-Jorgenson et al., "Cosmic Study on Space Traffic Management" (Paper prepared for the International Academy of Astronautics, 2006) online: International Academy of Astronautics <http://iaaweb.org/iaa/Studies/spacetraffic.pdf>.
[16] Inter-Agency Debris Coordination Committee, *IADC Space Debris Mitigation Guidelines* (2007), online: Inter-Agency Space Debris Coordination Committee <http://www.iadconline.org/> [*IADC Guidelines*].
[17] International Telecommunication Union, online: International Telecommunication Union <http://www.itu.org> (713 non-governmental entities with 567 Sector Members and 146 Associate Members).
[18] See e.g. *Radio Regulations*, *supra* note 12 at Article 8 (Master International Frequency Registration).

coordination service[19] in return for the additional expense of compliance. Carving out a place for such a body, which provides it the carrots needed to obtain full compliance, is a difficult task; mere egalitarian principles unfortunately are not sufficient.

Safety to people and property on the surface, in orbit, and in the space environment itself should be the primary goals for such standards. As there are no agreed standards within the existing space treaties and the disparate interests of the parties discussing the prospects of such a management system, the first goal must be to link any proposed standard to universal objectives, or standards meeting only the highest common denominator. Safe and efficient operations are the fundamental objectives for traffic management. Therefore, the question of delimitation[20] or the requirement of transparency for government space activity[21] may not be necessary to advance the more fundamental goals of a standards setting regime. It is difficult to break the connection between space law and arms control due to its historic links. But such linkage is outdated by the current commercial environment and will either block consensus on such standards or, worse, create a false sense of space security through hollow provisions.[22]

Security is not a new trend in space but rather a permanent requirement. In no other international forum is so much at stake with so little safeguard against intentional interference. The norm for international commons is for state activity to operate with due regard for the international standards, but not to be bound by them.[23] This accommodation facilitates the security function which state craft performs. Security remains a legitimate state interest[24] and may be augmented by regional security arrangements[25] in order to protect its nationals and their property. The significant reliance of state government and the economic interests in space applications require it.

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[19] 10 U.S.C. §2274 (i) (Department of Defense to provide satellite tracking support to entities outside the United States Government through the Commercial and Foreign Entities (CFE) program).
[20] *Contra* Susan J. Trepczynski, *Edge of Space: Emerging Technologies, The "New" Space Industry, and the Continuing Debate on the Delimitation of Outer Space* (LL.M. Thesis, McGill University Institute of Air and Space Law, 2006) [unpublished].
[21] *Contra* Theresa Hitchens, *Future Security in Space: Charting a Cooperative Course* (Washington: Center for Defense Information, 2004).
[22] Paul A. DeSutter, "Is An Outer Space Arms Control Treaty Verifiable?" (Remarks to the George C. Marshall Institute Roundtable at the National Press Club, Washington D.C., 4 March 2008).
[23] *Supra* note 12, *Chicago Convention* at Article 3, *Law of the Sea* at Articles 95 & 96, *ITU Constitution* at Article 48.
[24] *Charter of the United Nations* at Article 51.
[25] *Ibid.* at Article 52.

Given the limitations in the scope of supervision standards recommended above, the difficulty for space traffic management is addressing the activity of private operators performing state activities for their government consumers. Perhaps a bright line needs to be drawn between private and state spacecraft as is done in other forums.[26] Also, with regard to state assertions that the state retains the right to *control* space,[27] it is important to note that in all other forums states reserve the right to exert *control* over some objects within the international commons as required by an emergency or armed conflict.[28]

Attribution of all space activity to a responsible state was obtained by the drafters of the *Outer Space Treaty* in theory. As the number of space faring states, entities, and launch and reentry sites grow, the inability to properly attribute space activity would eviscerate the *treaty*. The void yet to be filled by the *Registration Convention* may be largely closed by an effective space traffic management system. Additionally, the question of what body can establish binding supervision standards, how such standards are to remain responsive to changing technology, and what enforcement mechanism will permit timely action to prevent a catastrophic loss in space (such as a collision with a space station or debris creation in the GSO or SSO) are critical to the success of space traffic management.[29] Implemented through national space administration or a supra-national body, states will continue to have domestic interests which affect the supervision of their national space activity. An impediment for this international body will be to obtain a wide enough mandate to produce effective standards while not promulgating a comprehensive but unsupportable space regime which strays from the fundamental purpose of Article VI.

The danger of State Parties' failure to implement a supervision regime is to effectively amend this obligation through subsequent state practice.[30] The United States in acutely exposed by the failure of other State Parties to implement supervision due to

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[26] *Supra* note 12, *Chicago Convention* at Article 3, *Law of the Sea* at Article 29, *ITU Constitution* at Article 48.
[27] *Contra Outer Space Treaty*, *supra* note 2 at Article II.
[28] The White House, *U.S. National Space Policy* (2006) [Unclassified].
[29] William Marshall, et al., "Space Traffic Management" (Paper presented by International Space University summer session at Beijing, 2007); Nicholas Bahr, et al., "ICAO for Space" (Draft white paper for the International Association for the Advancement of Space Safety, 2007)[unpublished].
[30] Ian Brownlie, *Principles of Public International Law* (Oxford and New York: Oxford University Press, 2003) at 601 ("Modification may also result from … the emergence of a new preemptory norm of general international law").

the disparity in the associated business costs to commercial space competitors.[31] Ultimately, the benefits of the close supervision undertaken by the United States are enjoyed by all space actors while the United States is equally exposed to the hazards dilatory states create.

Progress toward creating binding standards can be made in one of three ways. First, continue the course of encouraging ratification and compliance with the *Outer Space Treaty* by all space faring states[32] and the enacted implementation legislation.[33] Second, create an international body to promulgate the minimum standards to be implemented by the participating states.[34] Or, finally, create a supra-national organization to govern space activity conducted in the international commons.[35] Unless responsible measures are taken, the alternative is to question whether all states will be permitted to authorize space activity without demonstrating the ability to supervise it.[36]

C. Conclusion

The shift towards commercial activity is changing the traditional relationship between states and the commercial space sector. Commercial regulation is the most difficult challenge for space faring states to address as they are increasingly reliant upon commercial providers for their space needs while the global market for space applications outbids the state's budget capacity. A renewed interest in safety and security is required as our collective reliance on space is no longer merely beneficial, but necessary to sustain our present governmental and commercial capabilities. Safety has always played an important role in space activity as the environment is harsh and unforgiving. But, the world requires prudent steps which address commercial space flight and debris mitigation in order to protect the inhabitants and the space environment in the increasingly congested orbital planes. Meanwhile, the security of the world's space assets is necessitated by those disruptive forces who struggle against globalization and the integration of their societies. And, the more conventional threat is posed by those who

[31] Andrew C. Revkin, "Wanted: Traffic Cops For Space" *The New York Times* (18 February 2003).
[32] *Supra* note 22.
[33] *Supra* note 3; *Supra* note 4.
[34] *"ICAO for Space", supra* note 29.
[35] *Supra* note 8; *Supra* note 15.
[36] See e.g. *Law of the Sea*, *supra* note 12 at Article 94 (flag of convenience).

underestimate or choose to ignore the effects of their aggressive activity in near space. Unfortunately, the collective willingness to forego space security would only empower those determined to spoil its utility. Therefore, it is prudent for the space reliant states to protect the space environment from irresponsible commercial activities, preserve the capacity of the near space environment to support space applications, and secure the mutually beneficial space based utilities against intentionally harmful acts.

The future of supervision remains in question, thereby jeopardizing the principle of state responsibility for the conduct of national activity in space. The consequences of bad Space Traffic Management decisions will be most severe for the integrated societies increasingly reliant on space based utilities. Regardless of the model pursued, the space faring states must address their responsibility toward national activities in space. Abdication of this responsibility jeopardizes the utility of space applications which allow them to govern and endangers the tremendous benefits the world's economy reaps from the uses of space. As energy resources are strained, the ability to access and explore the world, transmit and receive digital information globally, and develop solar energy distribution and other space applications is more important than ever before.[37] A few decades ago the space legal community was reminded that an ounce of prevention is worth a pound of cure. Today the orbital debris formations and congested GSO and SSO orbits require good governance or the expense of operating in space will increase dramatically. The actions of non-governmental entities now enjoying the international laissez-faire commercial space environment will affect all future space activity. The remediation of hazards created by irresponsible actions is measured in billions of dollars and lifetimes.

[37] Jad Mouawad, "Plan Would Lift Saudi Oil Output to Highest Ever" *The New York Times* (14 June 2008).

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